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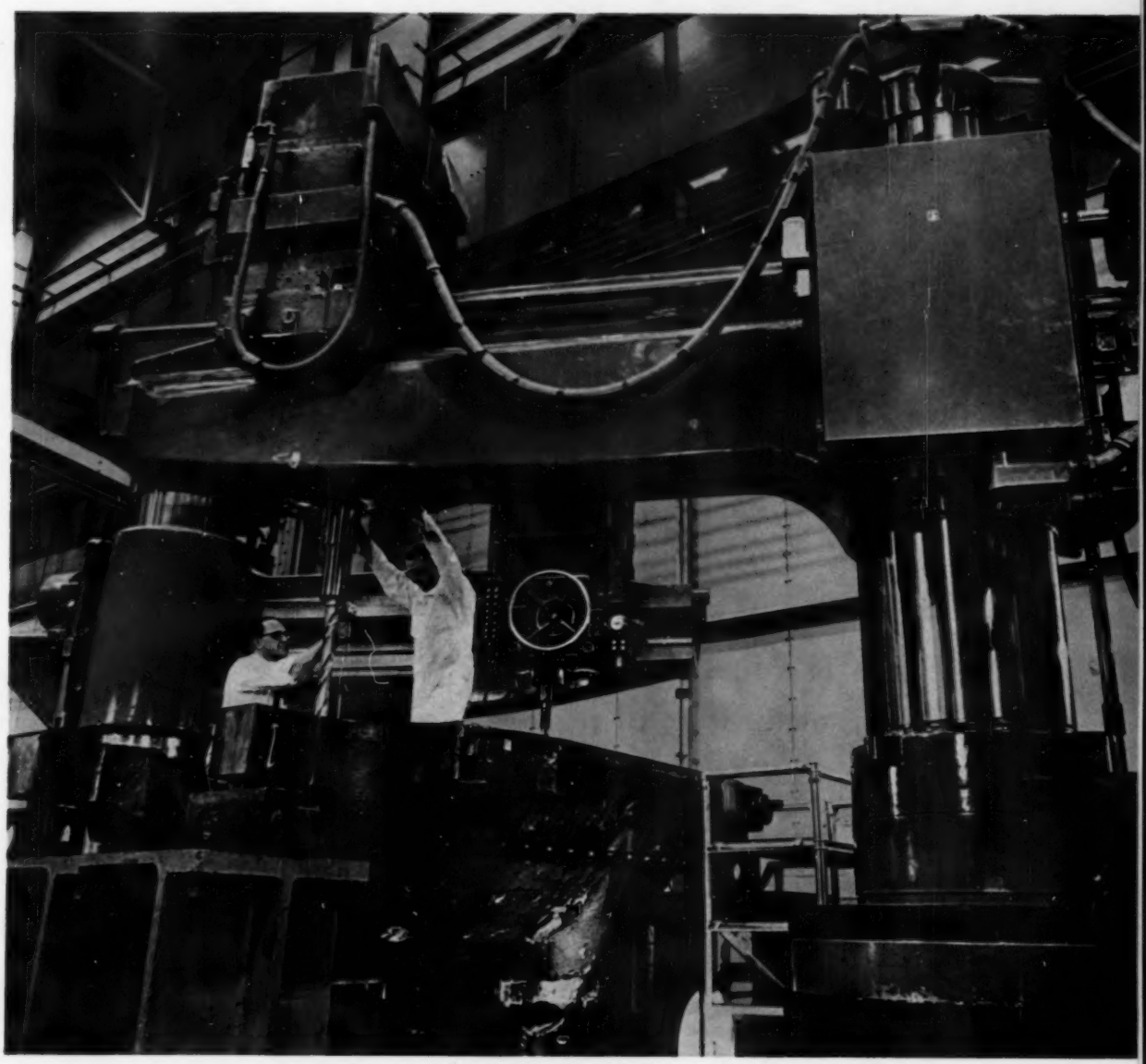

Twin 40-ton radials drill 46 holes in high-pressure shell—see page 1

A guide to **SUBLAND TOOLS**

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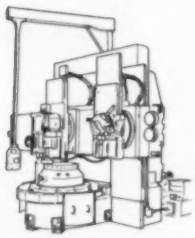
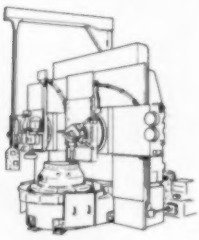
new

from HEALD



IT PRECISION GRINDS
I.D.s, O.D.s, Tapers and Faces



IT BORES, turns, faces
grooves and chamfers

MODEL 578 VERTICAL GRINDING MACHINE

speeds rebuilding of jet engines at United Air Lines

REFINISHING big jet engine parts calls for high precision internal and external grinding, as well as a variety of rough and finish boring, turning and facing operations. United Air Lines is meeting both of these requirements to excellent advantage with the completely new Heald Model 578 Vertical Grinding Machine shown above.

With two separate and independently controlled vertical slides — one for grinding and the other for Borizing — this massive unit is really two machines in one. Either vertical slide can be positioned over the work by indexing on a common cross rail. Both vertical slides have 20 inches of travel and can be swiveled 45° to either side of the vertical position for doing angular surfaces. The grinding head can be used for I.D., O.D. or rotary surface grinding and the turret-type Borizing head accommodates up to five boring bars. The work table will take parts up to 48" high and 52" in diameter and can be operated at speeds from 2½ to 180 rpm.

All operating controls are centralized on a pendant control box which can be raised or lowered 24" and swung to any area around the machine for operation from any position.

If your operations call for combined grinding and Borizing of large work, be sure to look into this radically new Heald machine. Your Heald engineer will be glad to give you complete information.

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COVER:

Two Cincinnati-Bickford radial drills at General Electric are adjusted by Frank J Famiano and Milford R Bishop. See p106.

American Machinist / *Metalworking Manufacturing*

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METALWORKING REPORT

Significant current developments in tooling and production processes

CUTTING

Speeds for Constant Tool Life

Feeds and speeds for cutting almost any material, from magnesium and brass to titanium alloys, can be quickly determined from a manual developed by Tapco Group of Thompson Ramo Wooldridge, with the assistance of Serge A Birn Co, management consultants. Unlike older methods of determining speeds and feeds, based on machine capacity or constant metal-removal rate, this system is based on constant tool life.

The system has been in use since last August, and has not yet shown any major flaws, say Tapco experts. Tables are developed especially for job-shop operations, and they reduce speed-feed calculations to simple fill-out-a-form arithmetic.

A complete description of this new development, of interest to any jobbing shop, will appear in a forthcoming issue of this magazine.

Subland Savings

One automotive plant reports fairly fantastic savings because they worked subland tools for multiple diameters into a mechanized machining line. Operation: drill and chamfer holes before tapping. Sixteen subland drilling-chamfering tools were installed in 16 spindles to substitute for 16 separate heads that would otherwise have been necessary. Tools cost $6 apiece, or $96, total. Heads replaced would have cost around $10,000 each, or $160,000. Savings: $159,904! This and other applications that show how subland tools make real savings in times, money, and labor are described more fully starting on p 115.

FORMING

Round-Table Transfer Press

Italy has a new twist on transfer presses—a circular design of 12-16 die sets with parts-handling fingers working inside the circle to move the work into and out of the dies.

The machine has a big rectangular ram guided by four round columns and fitted with cams that operate the parts-handling fingers. Stock feeds in from a coil and is blanked and drawn at the first station. From then on the parts are handed around the circle of die sets by fingers.

The presses range in capacity from 50 to 160 tons, with up to 60 strokes per minute, and draws up to 3 in. deep. Tooling for stamping and drawing, plus knurling, spinning, thread rolling, beading, circular trimming, and assembly with magazine feed is available.

Double-table presses work much the same, except that strip stock is zig-zag blanked at a central die, then fed alternately to both die-set circles with 17 stages each. Capacity of the double machine is 50 tons at 60 strokes per minute, and drawn depth of 2¾ in. Such parts as tubes, shells, lipstick holders, and the like are made complete.

Clutches and brakes are air-actuated, and air feeds the built-in cushions under the tooling stations. Die buttons and punches are easily interchanged, and punch height can be set by micrometer.

Examples of work produced were shown at the technical meeting of the Pressed Metal Institute, Cleveland, March 23-24, by Giorgio Gavazzi, general manager, Construzioni Meccaniche Benelli—Gavazzi of Florence, Italy.

Wind Tunnel Electroformed

A shortcut at Douglas Aircraft saved the shop from an almost impossible deep-boring job in nickel by electroforming a wind-tunnel section around an aluminum mandrel. The tunnel section, 12 ft long and tapering on the ID from 2 ft at one end to 3 in. at the other, has a wall thickness of ⅝ in. It is a critical section of Douglas' new hypersonic wind tunnel.

To avoid deep, difficult boring, an aluminum forging of 8230 lb was machined to the ID contour required, then nickel was plated on to build up the required ⅝ in. wall. This took six weeks of plating. The shell easily separated from the mandrel because of the difference in thermal expansion between aluminum and nickel. The same mandrel will help make more shells, see p103.

Lightening Forms Shells

Shock forming will get another impulse from Convair's Hi-Vo-Pac, an electrical underwater discharge technique that forms sheet metal to the inner contours of closed dies. Similar to but not quite the same as Republic's spark bomb (*AM*—Oct 19 '59, p 123), it vaporizes an initiating wire, which expands and creates water pressure, and shock, inside the work chamber.

Pressure is as high as 80,000 psi in proved laboratory units. Dies can be made of epoxy plastics in about two days. One advantage of the system is economy. For details, see page 104.

INSPECTION

Complete Contour Checker

Pratt & Whitney Tool Co is building a universal contour-measuring machine for nuclear-weapon components, to be delivered to Sandia Corp, the company set up by AEC to develop complete weapon systems. UNICOMM is a tape-controlled inspection machine that compares a part to a precision templet, then provides visual readout to 0.0005 in.

It can handle parts up to 52 in. long, 52 in. on the OD, and to a minimum of 10 in. on the ID at a rotary table and expanding arbor. Up to 24 Trans-O-Limit gages make simultaneous comparisons to the templet. Master gaging templets will be made on a $152,000 automatic miller to within 0.0001 in. (under load) driven by continuous-path numerical control.

The inspection machine can report deviations from the shape of the templet, or actual dimensions on the part being checked. A console control unit will operate as many as four UNICOMM machines, and will provide printed, tape, or visual display of inspected-part dimensions. The UNICOMM will cost $150,000, including associated equipment, such as a coordinate-measuring machine accurate to 0.0001 in., which will check the templets.

Hydrostatic Testing Speeded

Up to 30 simple castings can be hydrostatically tested per hr at pressures of 2500 to 5000 psi. Instead of laborious hand pumping, Philadelphia Bronze & Brass Corp uses a double-acting, air-driven hydraulic pump, a universal clamping table, and a high-pressure test stand.

Castings can be tested as fast as they are clamped pressure-tight. A twist of a valve then admits water at the desired pressure. The hydraulic pump, made by Aldrich Pump Co., Allentown, Pa, develops from 50 to 12,100 psi, and is operated by 90-psi plant air.

Small castings are tested on a stand devised by Philadelphia's engineering department. This device has a rubber-cushioned steel bottom plate and a steel upper plate, which is connected to a 50-ton hydraulic jack. Water enters the casting through the bottom plate after the upper plate is lowered on its guided rods and clamped.

The universal table is employed to test castings over 14 in. dia. The table is connected to the pump with high-pressure hoses.

Small-Parts Checker

Fully automatic measuring and sorting of small parts has been developed in West Germany. Alfred Gauthier Ginblt, Calmback/Euz has developed an 8-station machine that can be fed by one or two vibratory hoppers, or magazines if desired. Parts up to ¾ in. dia by 1¼ in. long are inspected on a 2-sec. cycle.

The Gauthier machine reports at a glance: (1) total measured workpieces, (2) total good, (3) total showing faults at measuring points, and (4) total workpieces processed. Deviations outside of tolerance are shown by a mechanically operated retention system at each tracer, and also registered by a counter. Thus, there is an opportunity to trace and eliminate the source of error for a specific dimension.

Large batches of turned or blanked parts can be checked for length, thickness, diameter, height of projections, and depth of recess. The measuring devices can be re-arranged or reset as desired for a new part.

THE OUTLOOK:

Metalworking production is holding steady, but the outlook is somewhat mixed. Steel inventories are well balanced, but many of the mills are cutting production. Steel and gray-iron founders report good business. Appliance sales continue at a good pace, and bearing manufacturers are doing well. ***See page 95.***

HEAT TREATING

Tool Life Increased 800%

Tool-steel thread rolls that were considered satisfactory when they produced 250,000 parts now turn out 2,000,000 parts as the result of an eight-stage heat treating process developed by Thomas Chatwin & Co, Great Tindal St, Birmingham 16, England. Basically a tool manufacturer, Chatwin developed the process for its own special-purpose tools.

Patents have been applied for but full details have not been released. As far as we can learn, the austenitizing stage is closely controlled to give a very high carbide diffusion. Subsequent transformation then produces a homogeneous matrix comparatively free from highly stressed constitutents associated with structures produced by conventional heat treatment. Increased toughness permits tools to be put into service at higher hardness values without fear of chipping.

Small tools manufactured and treated so far show increases in tool life ranging from 1½ to 8 times. Another example is a thread-milling hob. Here tool life before the first regrind was doubled, and life between subsequent regrinds was boosted 50%.

WELDING

Mig-Welding Refinements

Two new techniques may make a big change in Mig welding (metal-arc, inert-gas) with only small alterations in the process. Both will be described in papers at the Welding Convention and Show in Los Angeles next week.

One of them is based on a greater extension of welding wire from the contact point to the arc—as much as 5 in. The current, traveling through this distance, preheats the wire before it feeds into the arc and improves the process in several respects, according to W T DeLong, J H Bradbury, and H F Reid of the McKay Co, York, Pa.

They say that the deposition rate increases up to 50% for a given current setting in CO_2-shielded welding. The longer extension also reduces penetration without increasing spatter, an advantage for high-speed welding of thin materials and for surfacing applications.

Another development is related to this one but is based on the *shape* of the electrode wire rather than its extension. V H Godfrey of Page Steel and Wire Div of American Chain and Cable Co, Inc, says that a flattened electrode with a width-to-thickness ratio of about 3:1 has marked directional characteristics.

When its long axis is parallel to the direction of welding, it throws a narrow bead with deep penetration. When turned 90° to this position, it makes a wide, flat bead that still fuses well with the base metal. Between these two positions, the author claims the wire can be adjusted for diffffferent combinations of bead width and penetration.

FINISHING

Peening is Cleaning

Trans-Canada Airlines has been peening jet-engine turbine blades with small glass beads to remove oxide scale. This is a maintenance step taken after many hours of engine service, to remove accumulated scale that had to be taken off previously by hot nitric acid and etching solution. After cleaning, the blades are inspected for cracks.

Originally developed for abrasive blasting to increase metal fatigue strength, the process is called "Perfecto Peen" by Magnus Chemicals, Ltd. It removes the scale in seconds, removes less metal than acid treatment, and does not conceal the cracks, if any. Glass beads do not roughen or pit the metal, but they

do cold work to improve fatigue strength, even when the process is only required for cleaning.

Hot Pot

Galvanizing kettles that hold 200,000 lb of molten zinc—some kind of record—are involved in the production of structural steel for a 1619-ft-tall television tower—also a record. Some 340,000 lb of the tower framework are to be hot-dip galvanized for weather resistance. The large kettle size is necessary because the tower must be assembled into sections, then the sections erected to form the complete tower, all to check fits and joints. Then the tower will be disassembled into sections that can be galvanized complete. Galvanizing after fabrication permits the greatest practical coating thickness. Final erection will be at Portland, Me.

MATERIALS & COMPONENTS

Polka-Dot Tape

A completely new dimension—color—has been added to the recording of information on standard paper, metal, or plastic tape. The new media, patented by The Commonwealth Engineering Co of Ohio, in Dayton, is said to be of much wider scope and greater versatility than any perforated tape so far developed. It is designed for use with a new recorded information and data processing system for industrial applications.

An optically scanned, colored-dot pattern, using 10 different colors, replaces all perforations and increases total combinations to more than two quintillion (or 20 factorial). Actually, the total figure is:

2,432,902,008,176,640,000

For metalworking, the new tape is expected to provide a system of continuous-path, or contour, control which is less expensive than magnetic-tape systems yet capable of carrying a tremendous quantity of information in a small length of tape. Tape-reading equipment can be assembled to feed a machine director in proportion to the information needed—from the simplest positioning control to complex contouring equipment. Programming is similar to techniques used with perforated tape.

MANUFACTURING CONTROL

Less Paper; Less Work

Less paperwork at Chance Vought Aircraft, Inc, Dallas, saves the company an estimated $245,000 per year because only one form was eliminated. The culprit in this case was EFAI (which sounds sinister enough, but only means Engineering Floor Action Instruction). It was simply a stop-gap order for continued production based on engineering and drawing changes that would otherwise halt fabrication.

Somebody finally asked the question, "Is EFAI really necessary?" Investigation showed that the standard engineering order forms could be slightly modified to take over all the EFAI functions.

Result: in addition to impressive dollar savings, the company will also save 100,000 manhours/year and eliminate 1,200,000 copies of the form.

Data Transmission by Phone

With two new pieces of electronic equipment, you can transmit data on magnetic tape or punched cards by long-distance telephone. These devices work on regular toll telephone calls; can also be hooked up with telegraph wires.

Built to transmit magnetic-tape data, the IBM 7701 Magnetic-Tape Transmission Terminal sends data at the rate of 150 characters (30 words) a second—about 15 times as fast as human speech. Sending operator places a tape on the 7701, then dials the phone number of the receiver. As the "conversation" begins, data passes through a modulating subset that the telephone or telegraph company provides, then over the wires, and finally through a demodulating subset at the other end—into the receiving 7701. Message rates are of course the same as for voice conversations.

Second device is an attachment for IBM's Data Transceiver (first announced in 1954), which transmits punched-card data over phone lines. The new attachment—called in IBM terminology a "digital subset feature"—uses conventional dial-telephone lines. Until now, use of the Data Transceiver has required leased phone lines. At the receiving end of a call, 9 to 10 punched cards can be reproduced per minute.

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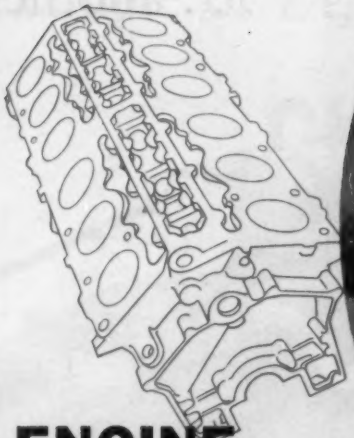

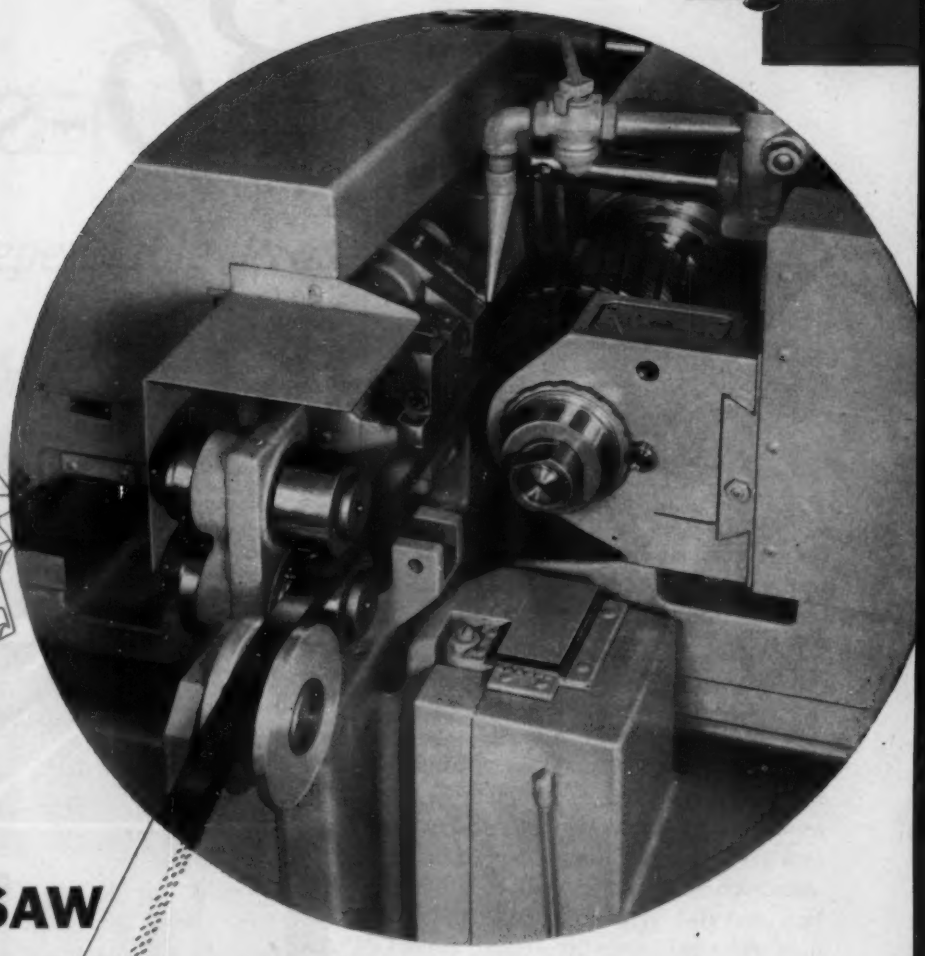

ENGINE BLOCKS

and BAND SAW BLADES . . . *produced at lowest cost on*

machines built by CINCINNATI | SPECIAL MACHINE DIVISION

Whatever the product, industry today shares a common problem . . . how to increase productivity and decrease costs. And the solution frequently is found in Cincinnati Milling's Special Machine Division, who design and build special machines and complete production lines for any industry.

Milling the teeth in ordinary band saw blades affords an interesting example of the Special Machine Division's dependable productivity. Their engineering specialists devised an automatic milling machine with a unique shuttling arrangement. In a completely automatic operation the stacked blades are advanced from reels by the shuttling action of the dual clamping fixture; saw teeth are milled with a 4" wide cutter, and a continuous box milling cycle permits uninterrupted clamping of the blades. The work advances for the next phase as the box milling cycle is completed. The driving gear on the full size 50 Series machine spindle is larger than the cutter itself, delivering the maximum capacity built into the machine.

What's *your* machining problem? The Special Machine Division will be glad to help. Now turn the page and see how Cincinnati builds dependable performance in a huge 36-station transfer line. **Special Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

SPECIAL MACHINES • COMPLETE PRODUCTION LINES
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SPECIAL MACHINE DIVISION

36-STATION

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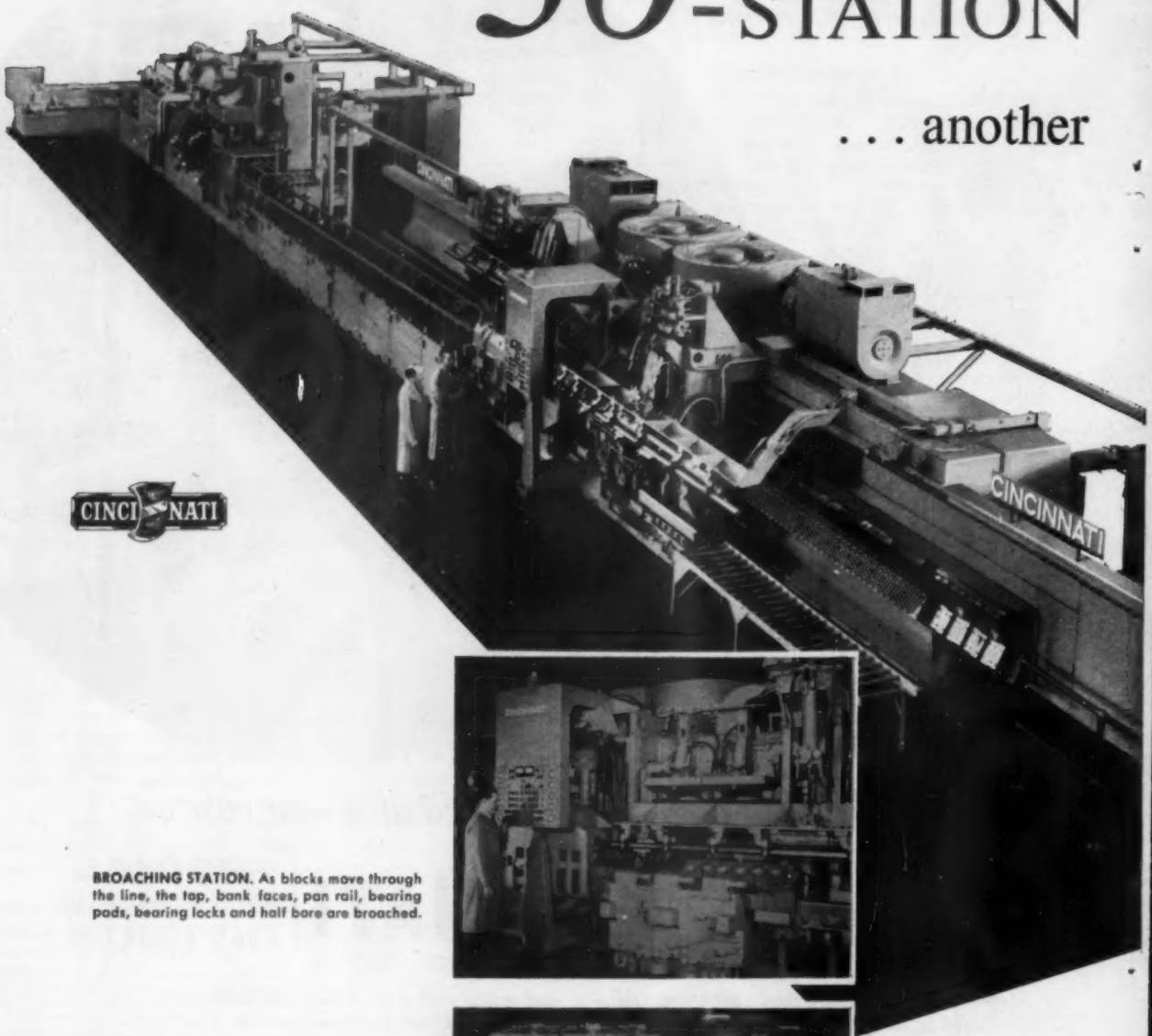

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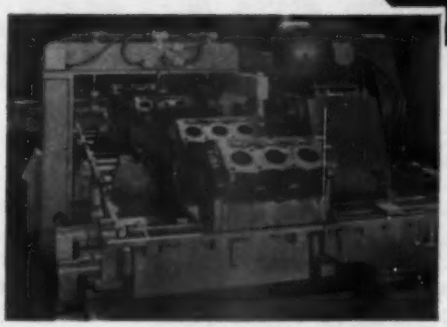
BROACHING STATION. As blocks move through the line, the top, bank faces, pan rail, bearing pads, bearing locks and half bore are broached.



MILLING STATION. Pads are milled on the side of the block, and the front and rear ends are rough and finish milled. Front of block is being milled in this photograph.

DESIGNERS AND BUILDERS OF SPECIAL MACHINES • VERTICAL AND HORIZONTAL BROACHING

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

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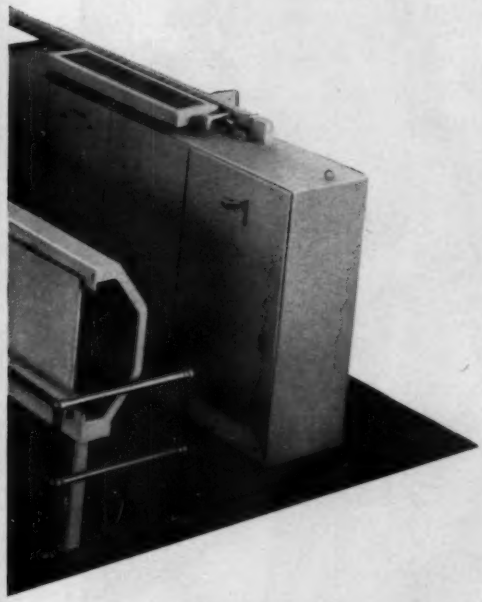
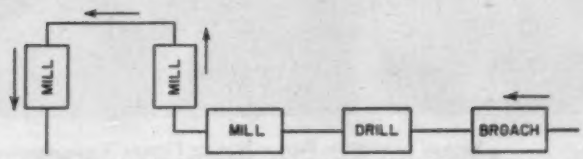
TRANSFER LINE

example of *Dependable Productivity* from

CINCINNATI | SPECIAL MACHINE DIVISION





CINCINNATI 36-STATION TRANSFER LINE broaches, mills, drills and reams V-type engine blocks . . . all in one continuous operation. Production—67 per 60 minute/hour.

In this special 36-station transfer line, the world's largest horizontal broaching machine is integrated with drilling and milling stations . . . for continuous, automatic machining of V-type automotive engine blocks. Cincinnati's Special Machine Division designed, built and assumed full responsibility for every detail of the line.

Twelve surfaces are machined on the broach, which has a 600 hp drive capable of developing a broaching force of 100 tons! Manufacturing holes then are drilled and reamed, and 10 surfaces milled, all in one continuous automatic operation. The line measures approximately 140 feet, and uses 30 motors capable of producing more than 1000 hp. Its design is such that three different bore sizes may be accommodated with very little change-over.

From the first broaching operation to the final interlock station, this giant production line is evidence of the capabilities of the Special Machine Division. In addition to over 45 years' experience in designing and building special machinery, Cincinnati offers the most extensive research and development, foundry and shop facilities in the machine tool industry. And you will be pleased with Cincinnati's follow-up service to assure dependability of performance. Our Field Engineers will be glad to give you an analysis of what the Special Machine Division can do for you.

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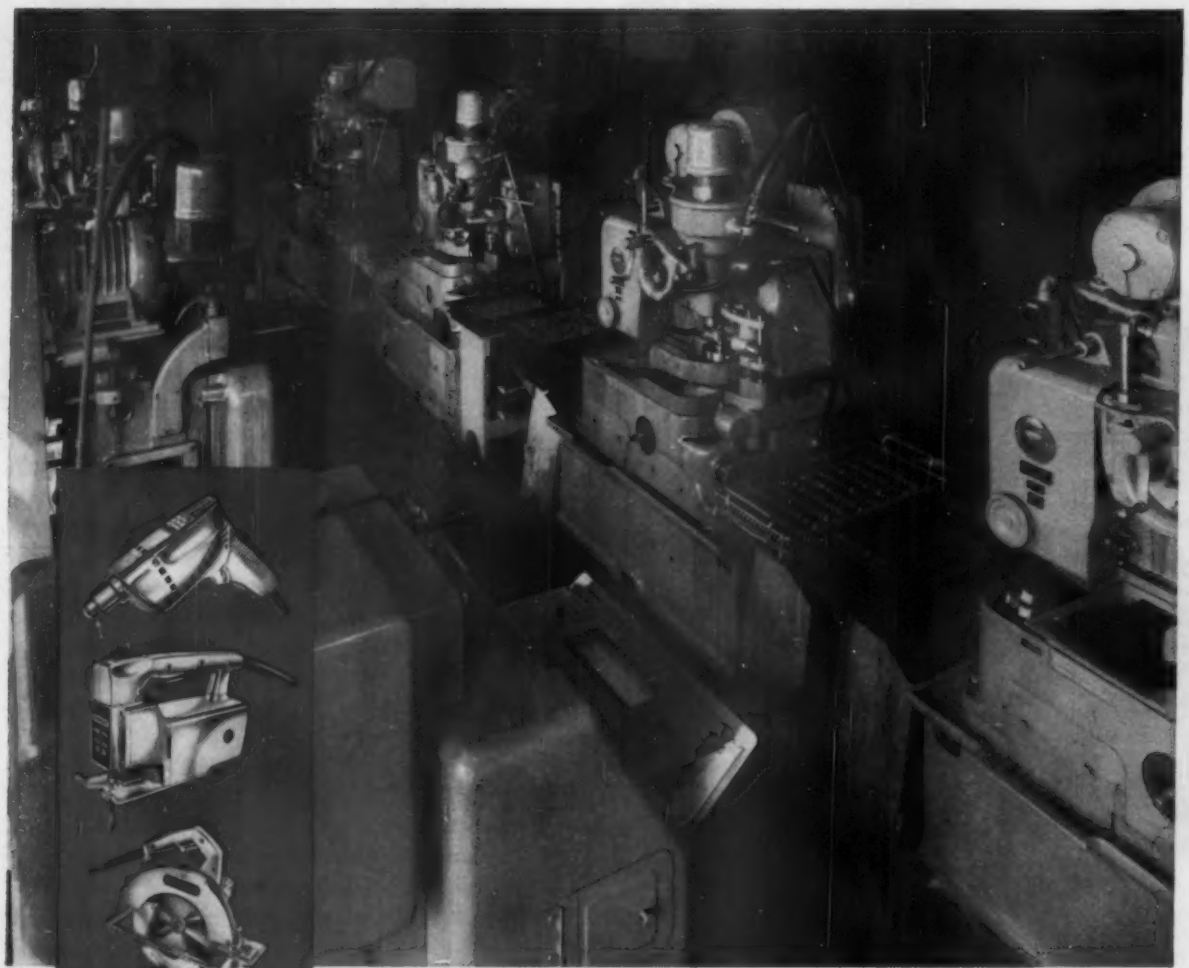


View of production floor at Stanley Electric Tools, showing some of the Fellows Gear Production Equipment used.

Gears produced with Fellows Machines add high quality to these Stanley Electric Tools.

THE PRECISION LINE

Fellows

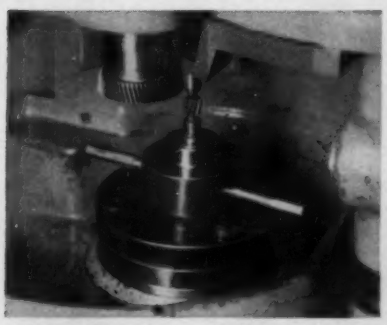
EQUIPMENT at Lower Cost for STANLEY

Stanley is a name you know . . . a name that stands for high quality in electric tools.

To insure this quality, while providing the high production rates that mean lower costs, Stanley Electric Tools, Division of The Stanley Works at New Britain, Conn., uses Fellows Gear Production Equipment for shaping, shaving and inspecting the armature pinions for its electric tools.

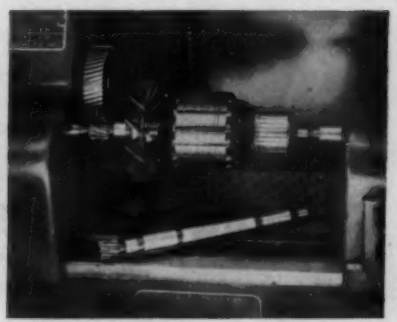
Fellows has long been the leader in Gear Production Equipment, with machines for every gear production job: Fellows Gear Shapers, Pfauter Gear Hobbers, Fellows-Reishauer Gear Grinding Machines, Fellows Gear Shaving Machines and Fellows Inspection Instruments.

If you make gears of any size, from 1/16″ P.D. to 120″ P.D., Fellows' 60 years of experience can help you improve quality and cut costs. For complete information on Fellows Gear Production Equipment, call your nearest Fellows office.



SHAPING. The versatile No. 7125 Fellows Gear Shaper gives Stanley high production speeds (up to 450 strokes per minute). It also provides fast, simple changeover from one job to another.

SHAVING. The No. 4 Fellows Fine Pitch Shaving Machine puts finishing touches on each pinion and adds the finish which results in long life and quiet operation.

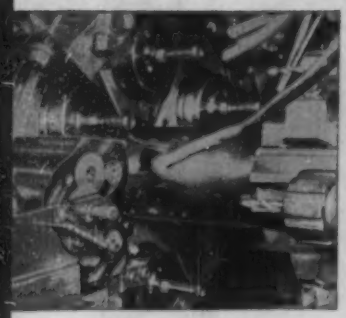


INSPECTING. The No. 4 Fellows Fine Pitch Red Liner makes and records a composite check of gear accuracy, insuring high quality standards.

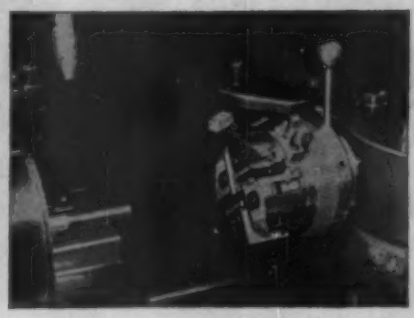
Gear Production Equipment

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:
319 Fisher Building, Detroit 2
150 West Pleasant Avenue, Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Avenue, Los Angeles 45

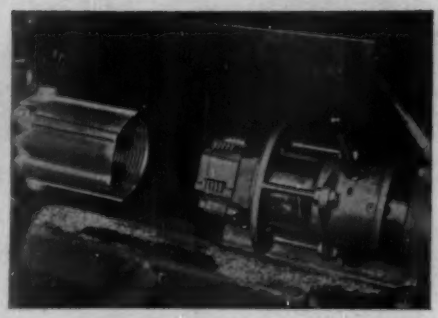
How Landis guarantees



Rolling over 30 million threads

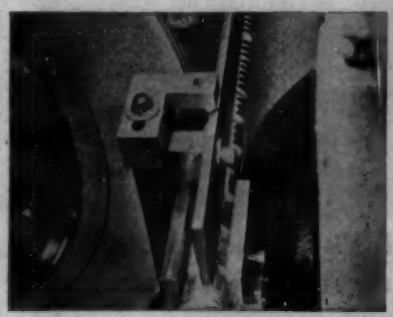


Cutting to .001 concentricity



Tapping coarse threads in less than a minute in one pass

"threading results desired"



Grinding threads 7¼" per minute

The service after purchase each Landis customer receives is his guarantee that Landis equipment will produce threads that meet the degree of accuracy and production for which it was sold.

How does this guarantee work? Since our customers are also our best prospects we provide a multitude of services designed to meet their needs for attention, help and continued satisfactory operation of their Landis purchases.

SALES AND SERVICE REPRESENTATIVES . . . nationwide network . . . factory trained to apply Landis equipment to the most efficient method of operation and keep it performing as such . . . accurate home-office records of customer equipment and operation assures efficient service.

COMPLETE LINE . . . of threading equipment enabling use of machine or tool best suited for the operation whether it be Cutting, Rolling, Tapping, Grinding . . . adequate inventory assures fast delivery.

LITERATURE . . . regular contact by mail keeps customer well informed . . . catalogs and operational handbooks received at time of purchase . . . demonstration movies available.

ENGINEERING ASSISTANCE . . . leading engineers in the field offer help in analyzing and solving threading problems.

NEW PRODUCTS . . . research and development bring even better ways to further meet threading requirements.

QUALITY MANUFACTURE . . . rigid control and fine craftsmanship guarantees threading equipment that will perform with top efficiency, give maximum life, produce accurate threads.

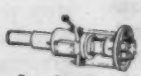
Satisfied customers are our best recommendation. Investigate today the advantages Landis threading equipment has to offer for your plant.

LANDIS *Machine* COMPANY

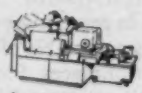
WAYNESBORO • PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

Threading Machines



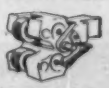
Taps—Collapsible & Solid Adjustable



Centerless Thread Grinding Machines

Thread Rolling Machines

Die Heads—Rotary & Stationary



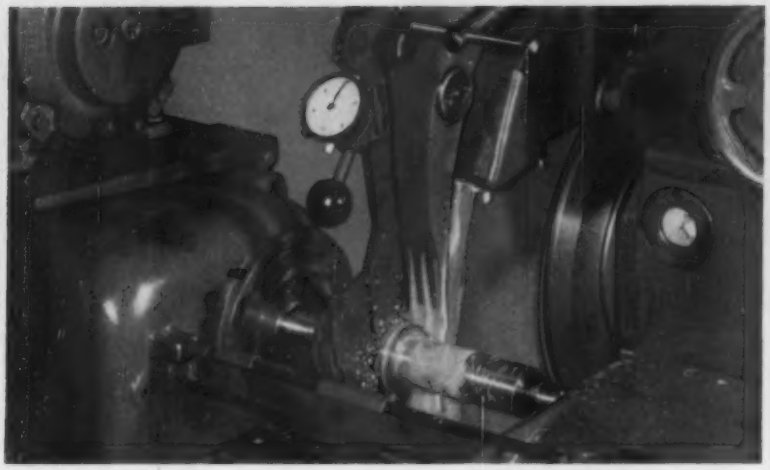
Thread Rolling Tools

MMT-PE

BOOTH NO. 432

The inside story of Landis Microfeed

How Microfeed automatically cancels

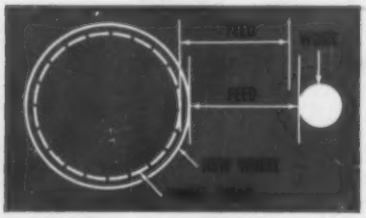


A major problem in cylindrical grinding now solved

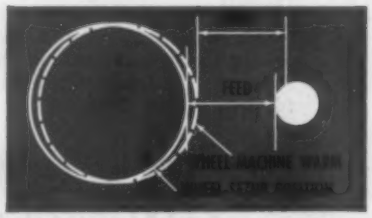
Under the pressure for high production, closer tolerances, uniformity and less operator skill, users of precision cylindrical grinders have recently become more concerned with the many variables that affect work size. While these variables have always been accepted as part of the normal operation of a cylindrical grinder, under today's schedules they can be costly liabilities. A close look at some of these variables and their effect on production and precision shows why there is a vital need for Landis Microfeed today.

Variables that affect work size

Wheel Wear. In repetitive operations wheel wear is noticeable after grinding a number of pieces. Final size of the work will start to drift to the high limit. To correct this condition, the operator must make a feed compensation by re-adjusting the feed handwheel.



Temperature Variations. A grinding machine will change dimensionally when it absorbs the elevated temperatures of hydraulic oil and coolant. This causes work to be ground undersize. Here again a wheel feed re-adjustment is necessary.



. . . And These Other Variables: Repeatability of the forward feed stop position, sparkout variations, wheel loading, variations in wheel grading, variations in material being ground and variations in feed rates due to hydraulic oil changes . . . all these variables affect the tolerances for size, roundness and finish.

These variables lower production because of the time needed by the operator in adjusting the feed handwheel and in gaging workpieces. These variables will lower the efficiency of any grinding operation using an in-process gage.

**Patent Applied For*

equipped with MICROFEED

Landis Microfeed automatically cancels all variables affecting work size

Microfeed was developed by Landis engineers to automatically cancel these variables. Microfeed is an extremely fine feed to final size as indicated by an in-process gage. Microfeed advances the grinding wheel head in increments of 50 millionths of an inch after sparkout. It continues to feed the wheel head until the sizing gage signals finish size.

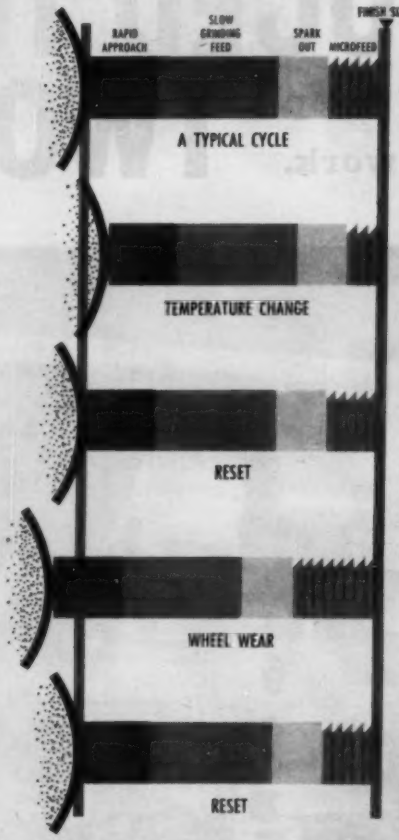
In addition, at the completion of the grinding cycle, Microfeed always resets a pre-determined number of 50 millionth inch reset increments *regardless* of the number of feed increments required to reach finish size. As Microfeed resets, the other feed elements reset to re-establish the ideal distance from the face of the wheel to finish size for the next cycle. The number of Microfeed reset increments can be varied to suit the condition of the machine, the grinding operation, the material and the wheel. Once set, it will not vary.

Why use Landis Microfeed

- Microfeed will grind workpieces to your closest tolerances . . . automatically.
- It automatically cancels the effect of grinding variables such as wheel wear, changes in machine temperature, wheel action and variations in workpieces.
- Microfeed eliminates the need for manual re-adjustments of the wheel feed handwheel to maintain tolerances.
- It gives uniform size, roundness and finish, at production rates, for maximum efficiency.
- Microfeed is applicable to any production or small lot job that justifies and uses automatic or visual gaging.

all variables affecting work size

Landis Microfeed grinding cycle (a graphic presentation—not to scale)



In the Microfeed cycle there is a rapid approach, slow grinding feed, timed sparkout and Microfeed increments to finish size. (Microfeed uses as few or as many feed increments as are necessary to achieve finish size as indicated by the sizing gage. In this graphic example, there are five Microfeed increments to finish size.)

When the machine is affected by increased temperature, the face of the grinding wheel moves closer to the work centerline—Microfeed (in this case) requires only *three* feed increments to reach final size.

At this point the wheel head retracts to its back position, the other feed elements reset and Microfeed resets a pre-determined amount (five increments in this case) automatically re-establishing the face of the wheel to the original setup position and thus cancelling the effect of the elevated machine temperature.

When wheel wear causes the face of the grinding wheel to be further away from its original position, Microfeed (in this case) requires *eight* feed increments to reach finish size.

Again the wheel head retracts, the other feed elements reset and Microfeed resets the same pre-determined number of increments (*five*) and re-establishes the wheel face to its original setup position. This automatically cancels the effect of wheel wear.

It will pay you to investigate Microfeed before buying new cylindrical grinding machines. Microfeed is available only on new Landis precision cylindrical grinders.

MMT PE

LANDIS

precision grinders

LANDIS TOOL COMPANY

WAYNESBORO, PENNSYLVANIA

General Machine Co. replaces 30-year old turret lathe with Warner & Swasey 2AC Single Spindle Chucking Automatic to cut manufacturing costs on gear cases and covers, and to keep bids competitive on subcontract work.

SEVEN OPERATIONS REDUCED TO TWO!

STATION 1 IN ACTION! Multiple cutter head with five individually adjusted cutters slab faces and rough machines both bores in gear case.

Lot sizes range from 100 to 300 pieces on these cast iron gear cases and covers. Note requirement for radial alignment of bushing so that its oil groove and the oil hole in the case will match properly. This is accomplished automatically in station 4 illustrated below.

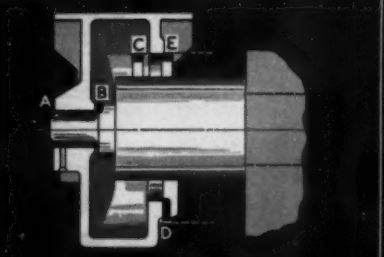
The General Machine Co., Emmaus, Pa., manufactures quality heating equipment sold under the "ELECTRIC FURNACE MAN" name. They also do contract machining, as a regular part of their business, for customers all over the country.

To maintain an acceptable profit margin on their product components as well as keep subcontract bids competitive—much of it on small lot work—General Machine installed a new Warner & Swasey 2 AC Single Spindle Chucking Automatic.

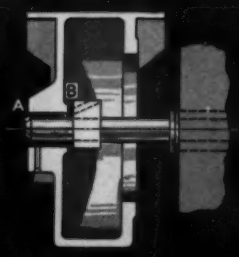
Because of the 2 AC's unique overhead turret design, which houses both turret and spindle bearings in the same temperature zone, problems of spindle rise are eliminated. As a result, General's shop people found they could easily hold single point boring tolerances of .0006 on a day-in-day-out basis.

This repetitive accuracy plus the 2 AC's unique versatility and ease of tooling permitted coal stoker gear cases and covers to be machined complete ready for paint in just two operations—one chucking for each part—including pressing-in and finish boring a bronze bushing. Previously seven operations were required—two machining, two arbor press, assembly of cover to case, line ream and disassembly. Five operations plus considerable part handling were eliminated!

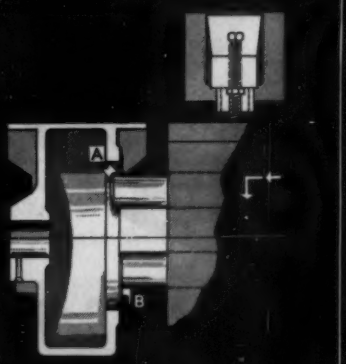
Maybe it's time for you to take a look at *your* costs with a W/S Field Engineer. Write us. Warner & Swasey Company, Cleveland 3, Ohio.



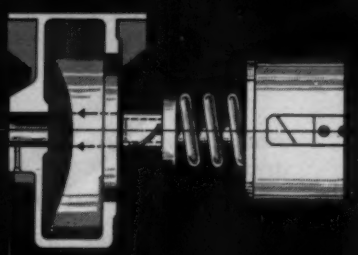
STATION 1. (A) Rough bores (B) Slab faces (C) Rough bores (D) Slab faces (E) Chamfers at 45°.



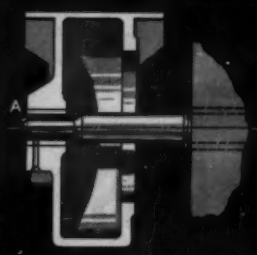
STATION 3. (A) Finish bores (B) Chamfers at 45°.



STATION 2. (A) Finish bores (B) Finish faces (late rear cross slide pushes turret mounted slide tool after (A) is completed).



STATION 4. Presses bushing. NOTE! Bushing loading tool is picked up and rotates with the fixture as it feeds forward establishing correct radial relation between bushing and gear case.



STATION 5. (A) Finish bores the bushing.

You can produce it better,
faster, for less with a
WARNER & SWASEY

W/S

New ARMSTRONG Swivel Pad can't come off

See us at
A S T E Show
Detroit
April 21-28
Booth 760

Now ARMSTRONG deep throat "C" Clamps have the new (Pat. apd. for) ARMSTRONG Ball-joint Swivel Pad. This "C" Clamp pad, developed by ARMSTRONG Engineers, is tougher than any on the market. Rigorous testing in our own plant first proved this fact, and field tests in factories throughout the country have confirmed our own test results.

Here's Why it's STRONGER . . .

The lip of the opening in the ARMSTRONG Ball-joint Swivel Pad is undercut so that when the ball of the screw is inserted, and the lip is permanently forced down, a solid steel wall is formed, inside the pad cavity, completely encircling the ball.

This wall of steel makes it impossible for the pad to come off the screw during normal use. In fact, our tests have proved that it is virtually impossible to intentionally knock the pad off with a hammer —yet the pad is free to swivel through an arc of approximately 40°.

Call your ARMSTRONG Distributor

Your ARMSTRONG Distributor can offer delivery from stock on this "400-Series" deep throat, drop-forged "C" Clamp with the new Ball-joint Swivel Pad. He also carries in stock the other styles of clamps in the ARMSTRONG Line—the broadest line of drop forged "C" Clamps.

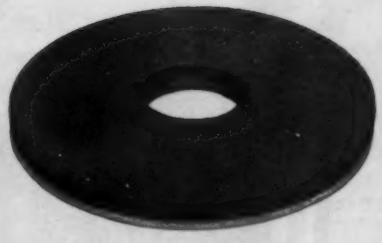
ARMSTRONG BROS. TOOL CO., 5215 W. ARMSTRONG AVE. CHICAGO 46, ILLINOIS

◄ CIRCLE 164 READER SERVICE CARD

CIRCLE 165 READER SERVICE CARD

Wide variety of Gardner abrasives assures top performance in all surfacing operations

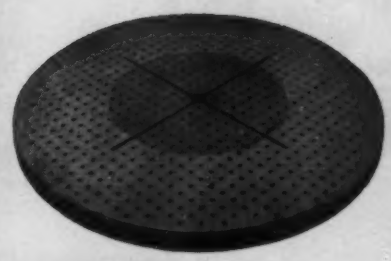
Segmental Wire-Lokt® discs for large horizontal grinders



Smooth faced Wire-Lokt discs for general purpose grinding

Narrow face disc with corrugations for cool cutting

Cylinder wheels for use on most popular types of vertical spindle grinders



Combination grade and face with radial lines for even wear and better coolant distribution

Cylinder wheels with square centers for fast stock removal on large areas

range of disc sizes

	diameter	thickness
regular disc	10" to 48"	1" to 3"
segmental disc	53" to 84"	1" to 3"
cylinder wheel	11" to 32"	4" or 5"
square center cylinder wheel	18" & 20"	4" or 5"

MMT PE

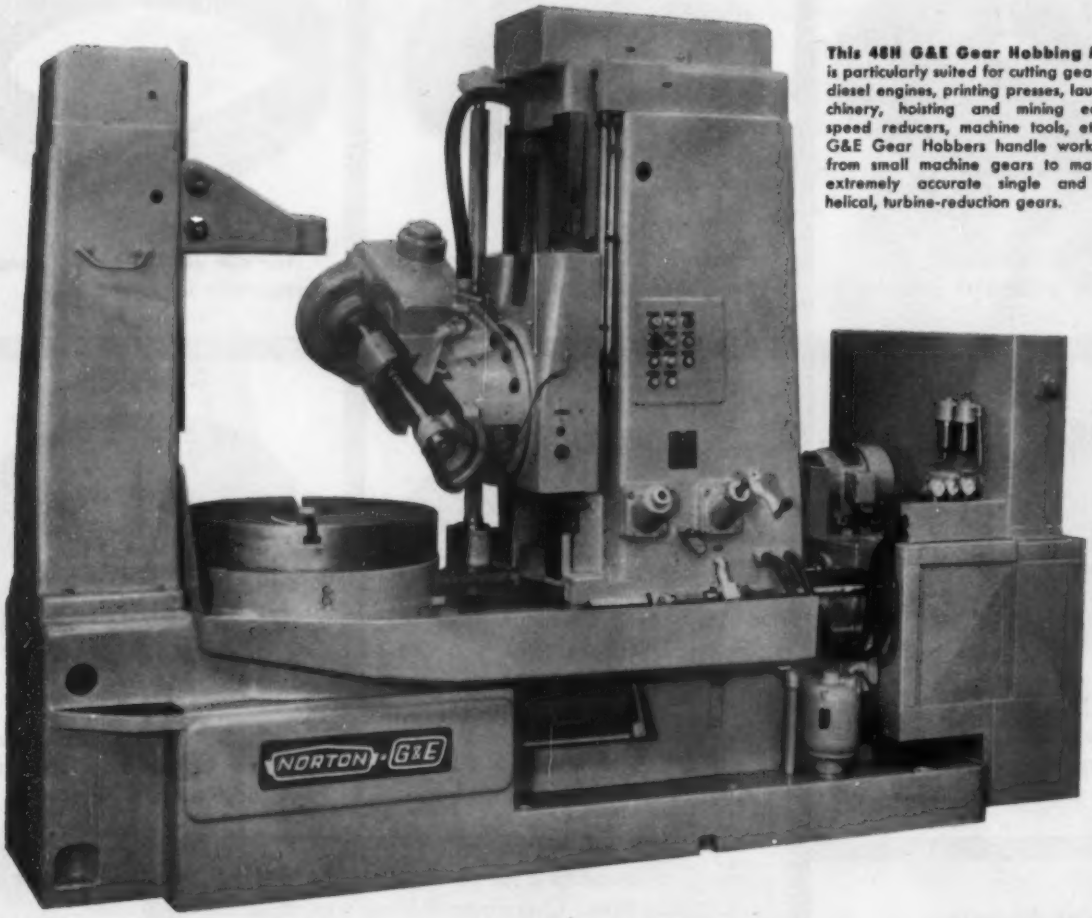
For a review of your finishing operations, call your Gardner Abrasives Specialist today.

GARDNER

abrasive discs

BELOIT, WISCONSIN

How G&E gear hobbers combine high precision with high production...



This 48H G&E Gear Hobbing Machine is particularly suited for cutting gears used in diesel engines, printing presses, laundry machinery, hoisting and mining equipment, speed reducers, machine tools, etc. Other G&E Gear Hobbers handle work ranging from small machine gears to massive yet extremely accurate single and double-helical, turbine-reduction gears.

for your high profits

367

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Gould & Eberhardt Universal Gear Hobbing Machines meet practically every industrial gear cutting requirement. Built for fast, dependable performance, they're established cost-cutters for rapid production of spur gears, single and double-helical gears, sprockets, splines, worm gears, worms, ratchets and special forms — in a wide range of pitches and diameters.

Highest production at lowest hob cost is assured by the highly developed vertical cutting principle, substantial hob support, gear trains and adjustment features.

And here's a fact it will pay you to remember:

The original productivity and accuracy built into hobbers by G & E is maintained at highest levels — and with every possible advancement — by the assimilation of G & E experience and personnel into the progressive and modern machine tool building operations of Norton Company.

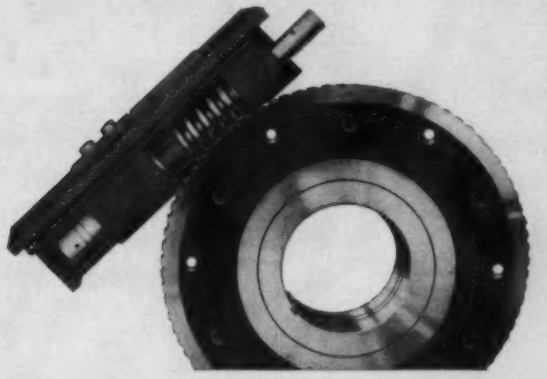
For careful help in selecting Gear Hobbers or other G & E equipment that will benefit your production see your G & E dealer or write to Norton Company, Gould & Eberhardt Division, Worcester 6, Massachusetts.

NORTON
MACHINE TOOLS

75 years of . . . Making better products
. . . to make your products better

HIGH PRECISION HIGHLIGHTS

Vertical Feed. Optimum accuracy is secured by a large diameter feed screw, precision-cut in a temperature-controlled laboratory and rigidly anchored in tapered, preloaded precision roller bearings. Backlash control is maintained by an easily adjusted two-piece bronze feed screw nut.



Indexing. DUALEAD® worm-gearing assures accurate indexing under heaviest production. The worm thread, with progressive variation throughout its length, simplifies adjustment by providing backlash control without change of center distance and insures uniform transmission of motion in both directions of rotations through proper conjugate tooth action, thus maintaining accuracy of index under high operating speeds and over an extended period.

The maximum wear-resistance quality of the mating chill-cast nickel bronze DUALEAD index worm gear results in minimum wear to maintain extreme accuracy longer.

HIGH PRODUCTION HIGHLIGHTS

Rapid, Precise Hobbing. Speed and accuracy for sustained high production rates — as well as extra-long service life of hobs and machines — are assured in G & E Hobbers because:

. . . The heavily proportioned, easily adjusted hob slide travels on double rectangular guides for sustained accuracy in basic motion.

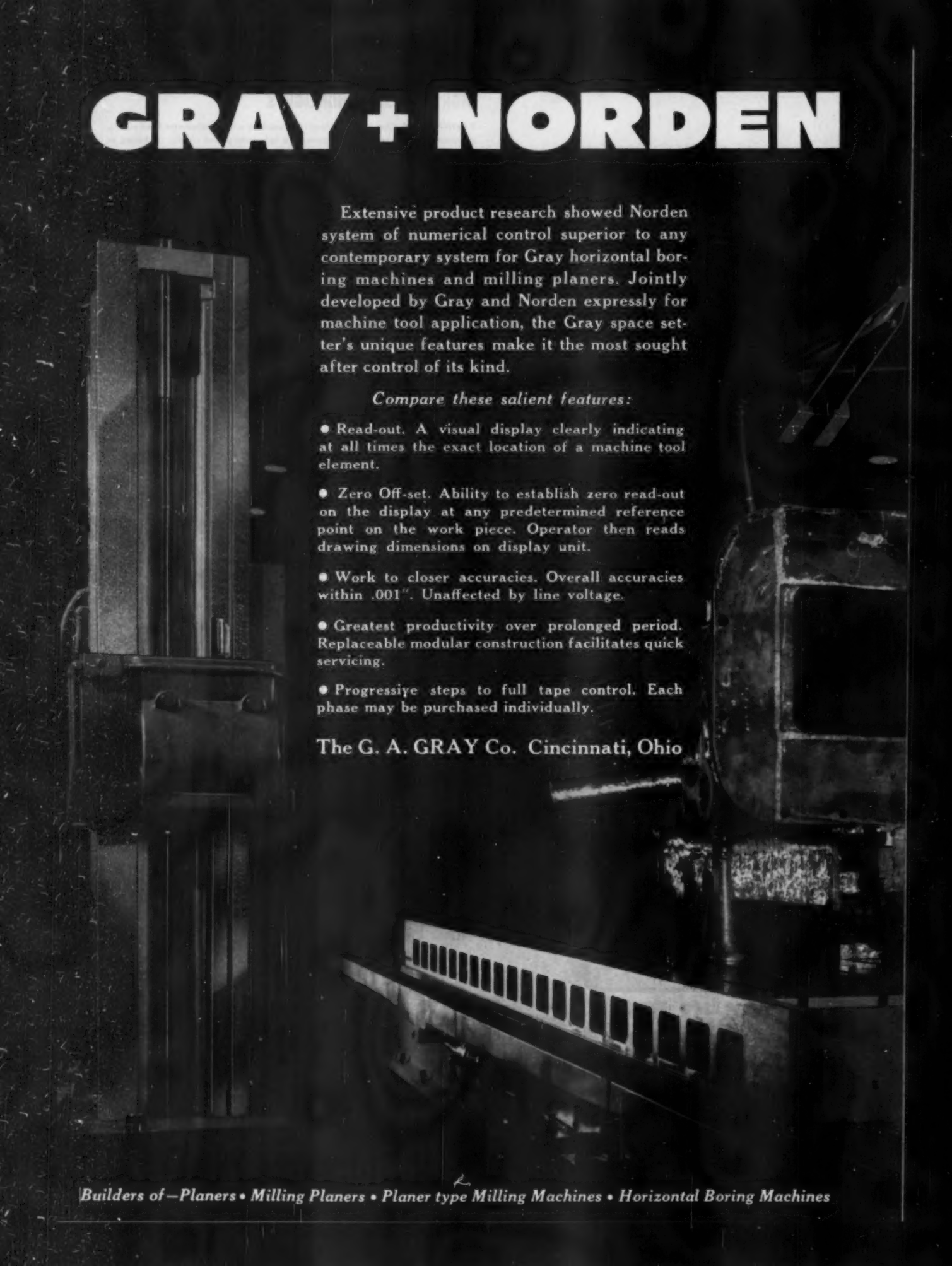
. . . The single-helical final-drive gear to the hob is independently mounted on large antifriction bearings to prevent compounding stresses on the hob spindle.

. . . The fixed-position work table is located in a large tapered bearing and supported by a flat annular bearing to absorb cutting stresses.

. . . The hob arbors are heat treated and chrome plated to reduce wear and eliminate the tendency to raise burrs which cause eccentricity and hob wobble.

MACHINE TOOL DIVISION: Grinding and Lapping Machines — G & E DIVISION: Shapers • Gear Cutting Machines • Gear Induction Hardeners

GRAY + NORDEN



Extensive product research showed Norden system of numerical control superior to any contemporary system for Gray horizontal boring machines and milling planers. Jointly developed by Gray and Norden expressly for machine tool application, the Gray space setter's unique features make it the most sought after control of its kind.

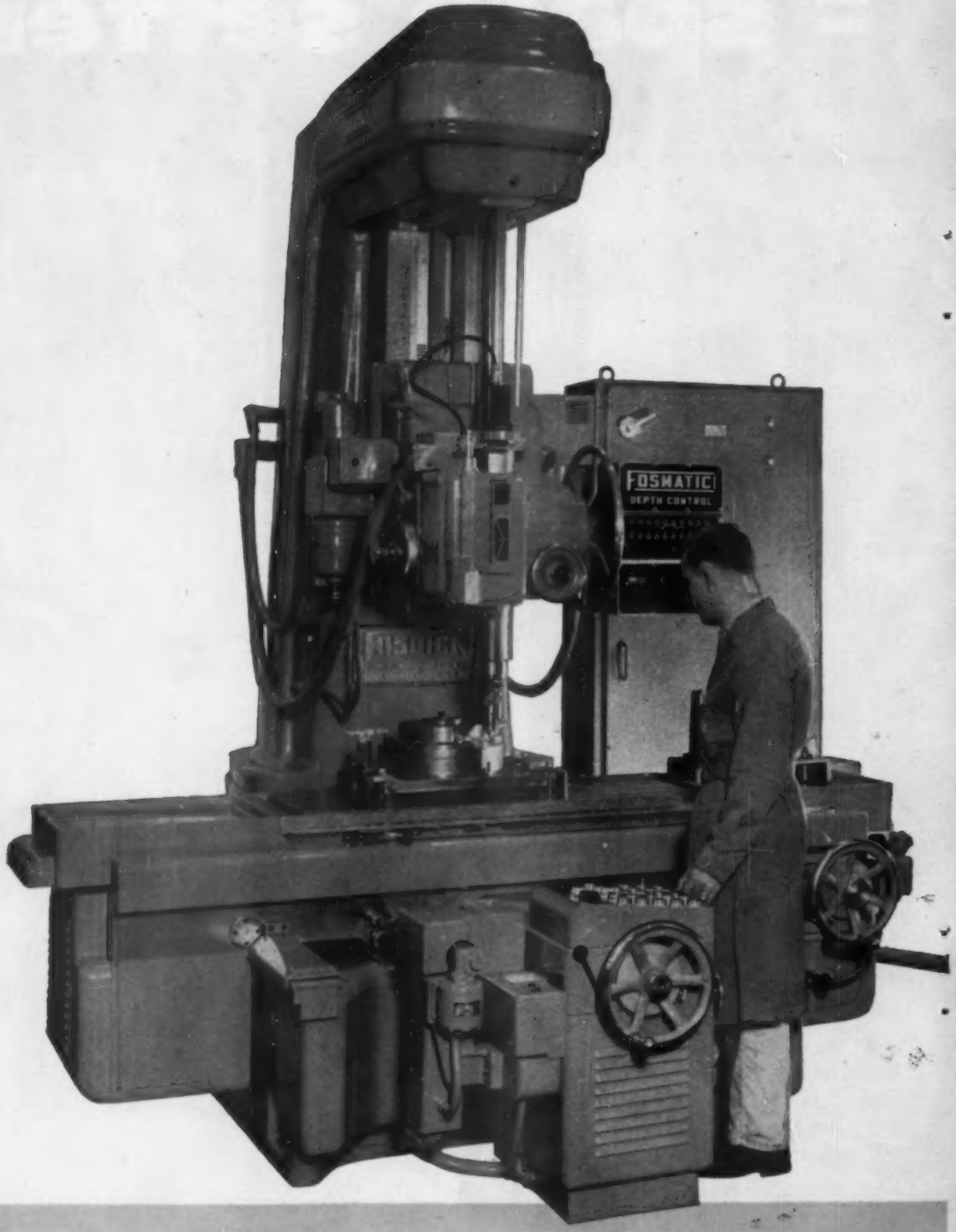
Compare these salient features:

- Read-out. A visual display clearly indicating at all times the exact location of a machine tool element.
- Zero Off-set. Ability to establish zero read-out on the display at any predetermined reference point on the work piece. Operator then reads drawing dimensions on display unit.
- Work to closer accuracies. Overall accuracies within .001". Unaffected by line voltage.
- Greatest productivity over prolonged period. Replaceable modular construction facilitates quick servicing.
- Progressive steps to full tape control. Each phase may be purchased individually.

The G. A. GRAY Co. Cincinnati, Ohio

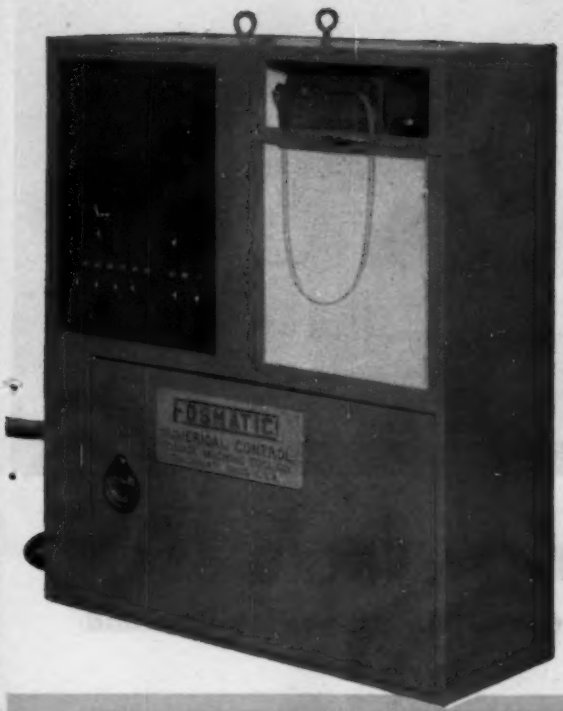
Builders of—Planers • Milling Planers • Planer type Milling Machines • Horizontal Boring Machines

= space setter



PRECISION

Numerical Control
in three directions



DEPTH CONTROL developed by Fosdick, adds the ultimate *third dimension* to precision boring. Use random length tools for boring to depth under complete numerical control. Combine rapid depth control with horizontal positioning, preselected spindle speeds and feeds, coolant on-off, tool selection, even automatic tool changing, all by Fosmatic Numerical Control.

Tape or dial any depth. Absolutely no stops to preset.

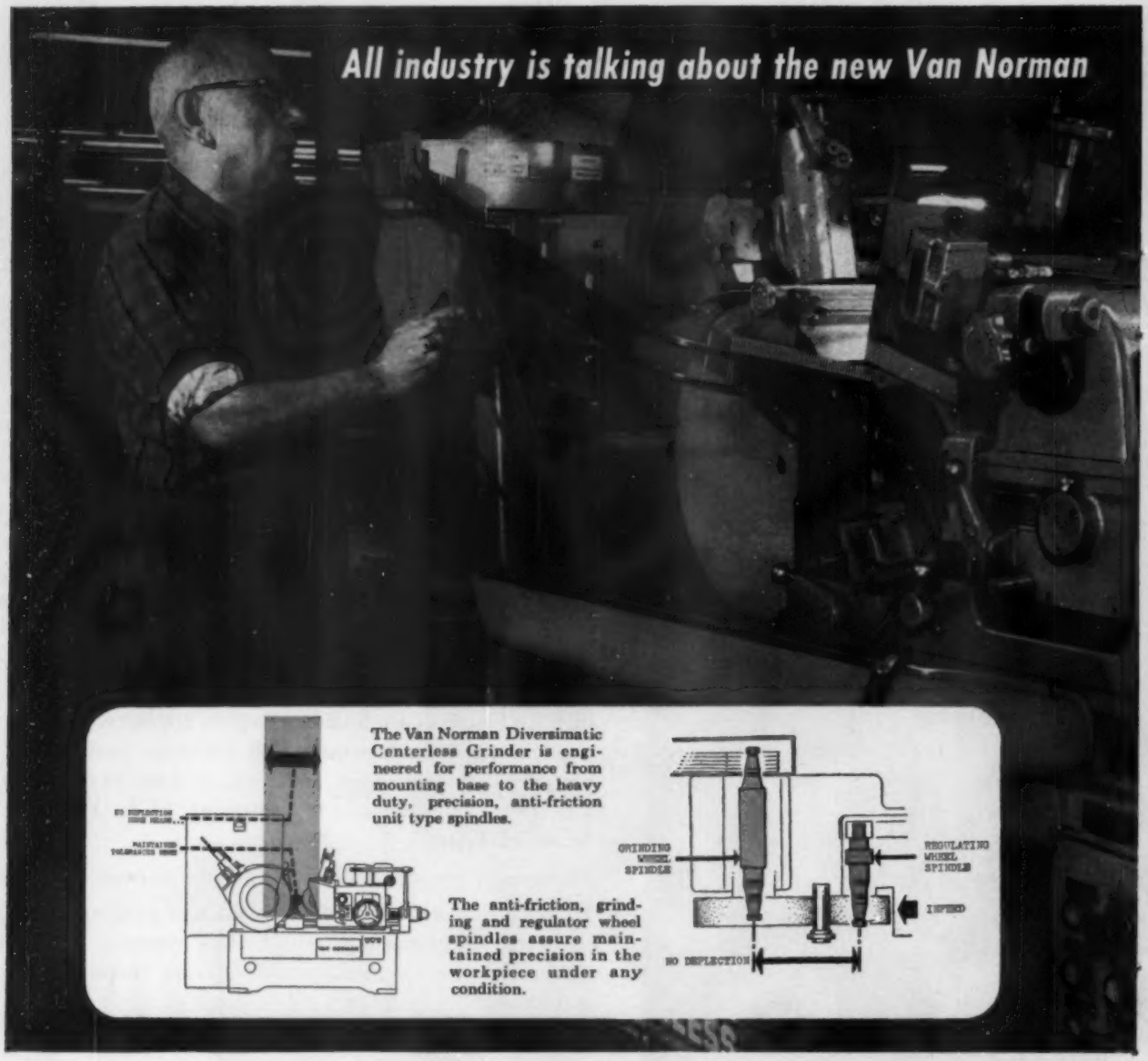
Fosmatic Numerical Control easily fits into a cabinet small as your home refrigerator. The Fosdick system is electromechanical. Its electrical components are simple, easily maintained.

Always, with or without numerical control, you depend on a Fosmatic for precision within 0.0001".

Keep precision machining control in the front office. Relieve the operator of his "fear of error." Investigate—and invest—in lower costs with Fosmatic precision, now. Write for Catalog PB-A.

BORING **FOSDICK**

THE FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, OHIO



The Van Norman Diversimatic Centerless Grinder is engineered for performance from mounting base to the heavy duty, precision, anti-friction unit type spindles.

The anti-friction, grinding and regulator wheel spindles assure maintained precision in the workpiece under any condition.

BENDIX CORPORATION BOOSTS SYNCRO SHAFT

VN Centerless Grinding cuts production operations, inspection time and

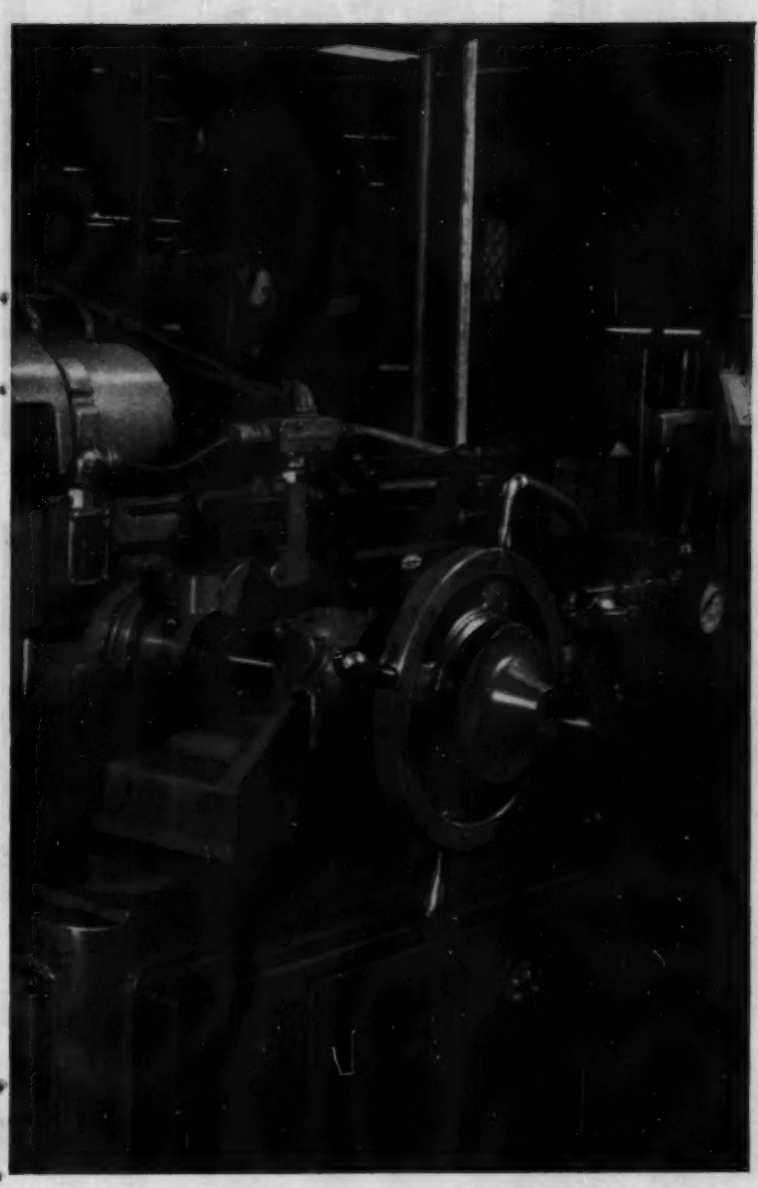
Bendix boosted hourly production of Autosyn syncro shafts to 600 per operator with a Van Norman Centerless Grinder. One Van Norman Centerless Grinder (with a specially developed automatic feed) replaced two manually fed machines, which produced only 50 shafts per hour.

Annual Savings $9,000—eliminating the need for highly skilled burnishing operators—100% inspection was eliminated. Concentricity control and improved tolerances were obtained with the Van Norman Centerless Grinder.

Faster Set-Ups . . . Increased Production . . . Greater Accuracy. The Van Norman Centerless Grinder is specifically engineered to produce more precision grinding per operator per work shift . . . designed for in-feed work,

VAN NORMAN

SPRINGFIELD 7, MASSACHUSETTS



PRODUCTION 1200%

material cost — saves $9,000 annually

thru-feed work, crush form grinding and profile work. The Van Norman Centerless Grinder is rugged, and designed for heavy duty, long run production.

Send For Free Booklet—"Centerless Grinding," your local VN Franchised Distributor will be happy to discuss how VN Centerless Grinding may increase production and cut costs for you . . . call him NOW!

MACHINE COMPANY

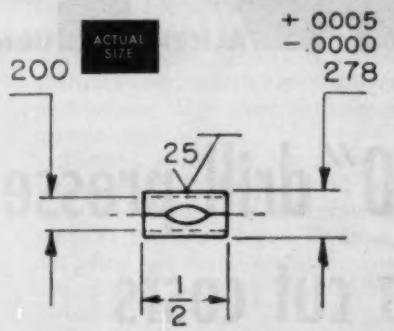
A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED

VN

3236

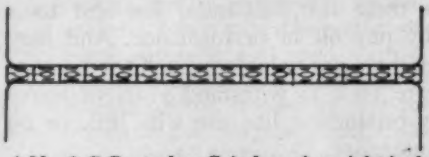
Another typical Van Norman centerless grinder cost-saving application

CUSTOMER'S PROBLEM:



Grind the .278″/.2785″ with an RMS of 25, or better, at a rate of 300 or more pieces per minute. The parts are rolled seamed carbon steel hardened to 56-58 Rockwell C. Machine to be hopper fed. Size to be held whether wheels are full of parts or scattered.

VAN NORMAN SOLUTION:



A No. 2-C Centerless Grinder using eight inch face wheels and vibratory hopper with a maximum feed rate of 410 pieces per minute was used. A P & W Air Gauge set limits of high and low to .0003″ or .0002″ less than allowed.

THE RESULT:

Van Norman ground 250 lbs. of parts—or 60,000 pieces—at 410 pieces per minute. Faster time was possible but the hopper could not handle a faster rate. All of the parts were ground without redressing the wheels. Size was held to well within the .0003″ allowable limits. Finish held to less than 15 RMS. Variation from piece-to-piece was not discernible. Wheel wear required a .0001″ compensation every five minutes to keep the .00025″ tolerance.

Customer reaction: complete satisfaction.

3 WAYS you can use

WT ALKER-TURNER

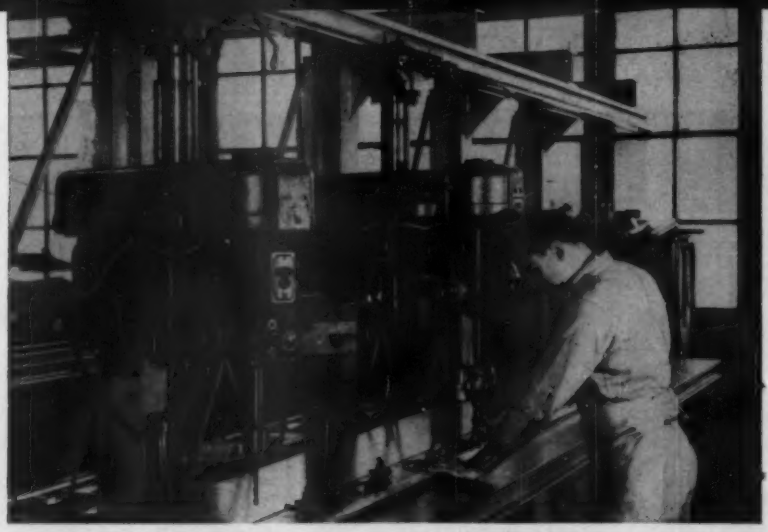
20″ drill presses to cut costs

Here are just three of the many ways you can save money using Walker-Turner "Light Heavyweight" 20″ drill presses for drilling and tapping operations. For standard applications or in special setups, you'll find that these fast, accurate, low-cost tools really pay off in performance. And they offer the *extra* value you look for because they're built to withstand years of heavy duty production line use with little or no maintenance.

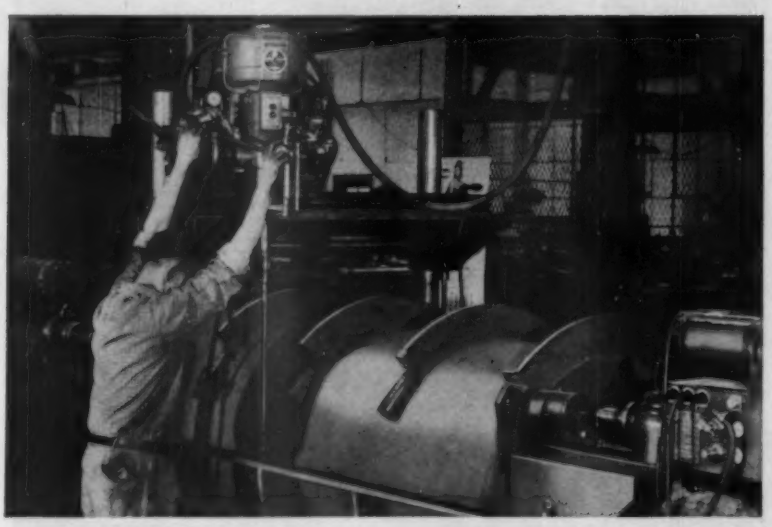
Ask your Walker-Turner Distributor (listed under "TOOLS" or "MACHINE TOOLS" in the Yellow Pages) about the money-saving advantages of using W-T tools and components. He'll gladly show you the full line of Walker-Turner 20″, 17″, 15″ and new 14″ Hi Speed drill presses in a variety of floor, bench and single or multiple spindle models to fit *your* needs.

For FREE CATALOG of the complete line W-T metalworking tools, write: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WD-21, 400 N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ontario.

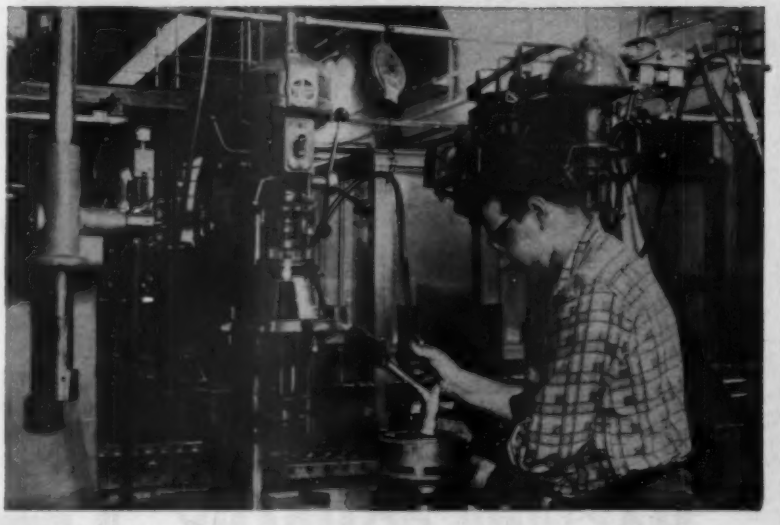
WALKER-TURNER
"LIGHT-HEAVYWEIGHT" MACHINE TOOLS
another fine product by
ROCKWELL



Rail mounted standard components



Carriage mounted special setup



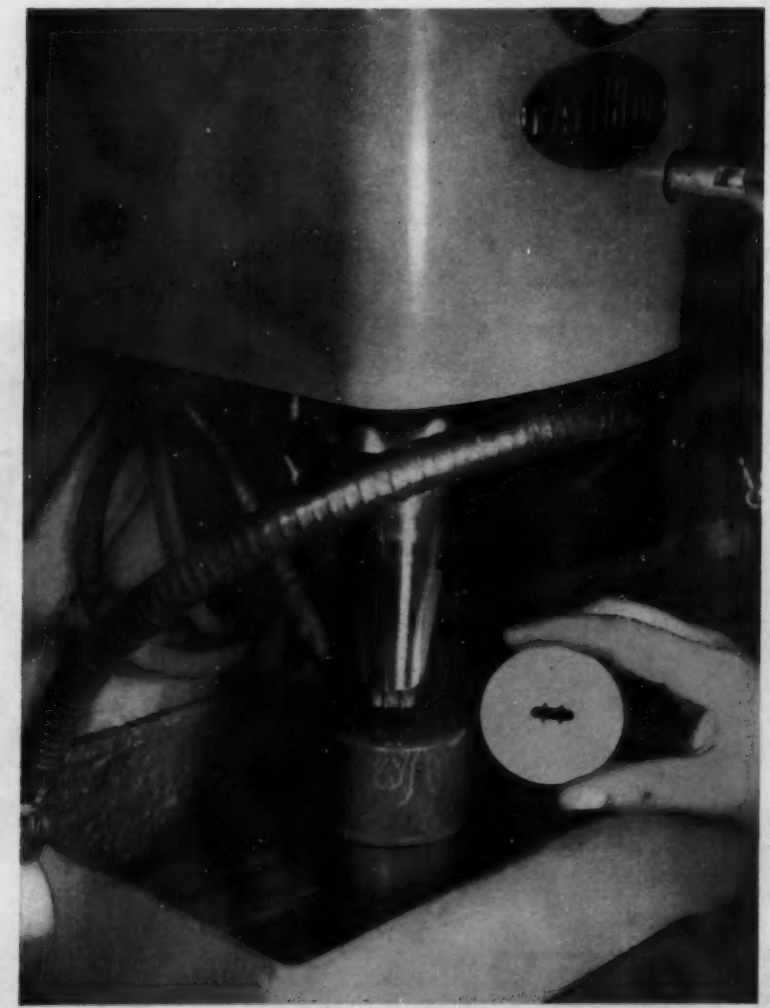
Equipped with multiple spindle attachment

Visit Walker-Turner in Booth No. 2236 at the A.S.T.E. Show

CIRCLE 175 READER SERVICE CARD

Ultrasonic Machining calls for ultra-modern abrasive

. . . NORBIDE boron carbide*



The Raytheon Company, a leading manufacturer of ultrasonic machine tools, recommends NORBIDE abrasive grain as the ideal cutting agent for ultrasonic grinding applications. Ultrasonic Machine Tools convert electric current into mechanical vibrations at rates up to 25,000 cycles per second, and drive abrasive against the work with an impact force 150,000 times the abrasive's own weight. In so doing they can machine an exact counterpart of the shaped tool face into the workpiece, as shown here.

With the tremendous increase in the demand for accuracy beyond the range of conventional machining, Norton NORBIDE abrasive is a vital aid to the exceptionally high precision performance of modern ultrasonic machine tools.

NORBIDE boron carbide grain is second only to diamonds in hardness. Compared to silicon carbide grain, it provides the same degree of finish, but being less friable maintains size and speed of cut for a much longer period of time.

Ultrasonic machining is of major importance in the electronics and metalworking industries, as well as in the manufacture of intricate jewelry and fine glass and laboratory ware. Materials machined include alumina, carbon blocks, ceramics, diamonite, ferrite, germanium, granite, graphite, silicon, tungsten, mother-of-pearl, sapphire, tool steel, carbide and other alloys. Operations include shaping, slicing, trepanning, engraving, cutting of intaglios, dicing, drilling and multi-drilling. In all applications, on all materials, NORBIDE abrasive grain is essential to high precision, sharp-edge accuracy without chipping, distorting or otherwise damaging the workpiece.

Your Norton Man can give you details on how ultrasonic machining with NORBIDE abrasive may improve and economize your production. See your Norton Distributor or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON

BORON CARBIDE

G-390

75 years of . . . **Making better products . . . to make your products better**

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEBB-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

CIRCLE 175 READER SERVICE CARD

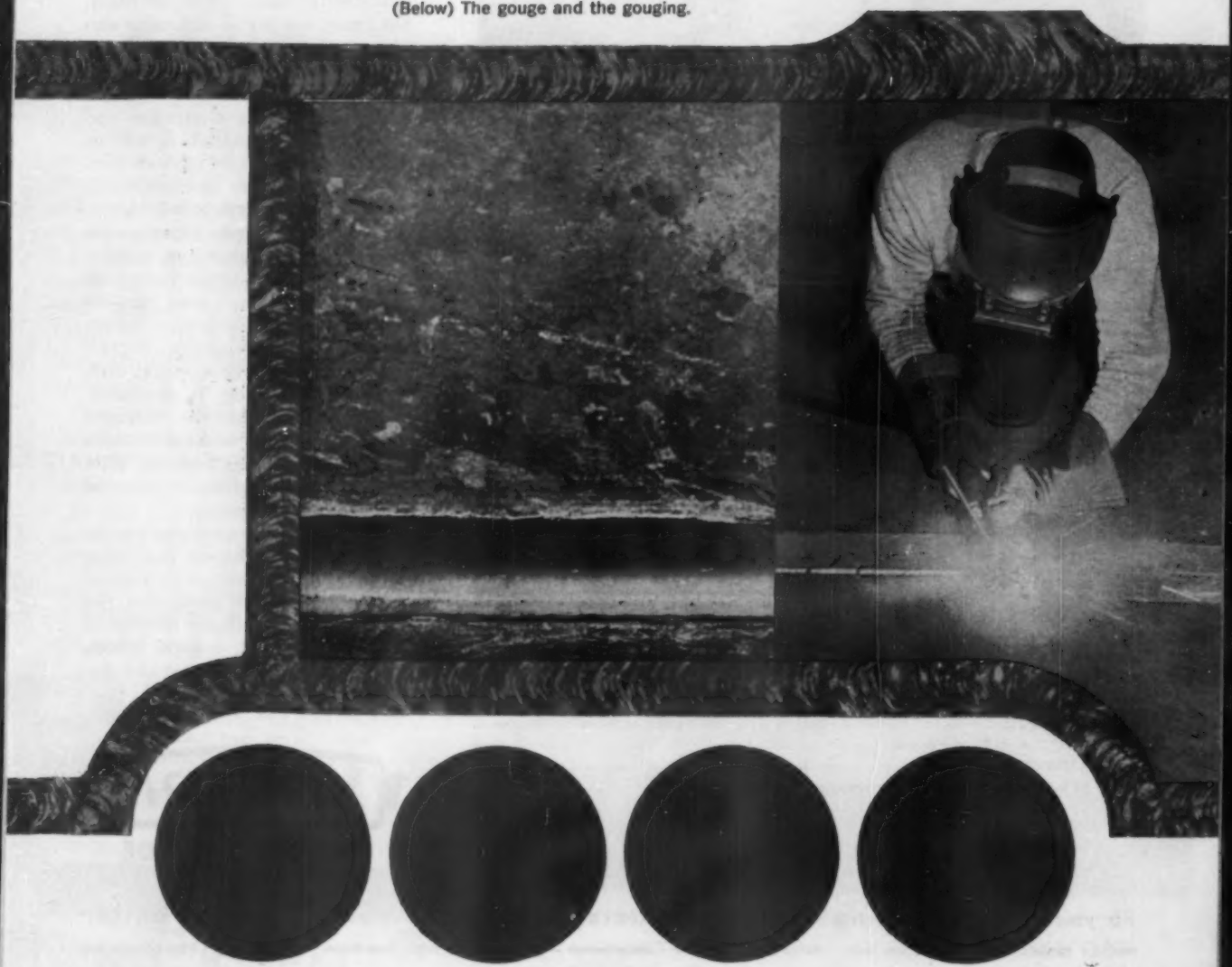
new Westinghouse WS silicon welder...

Arc-air gouging for metal removal offers an outstanding path to cost reduction. The new Westinghouse WS welder has been designed as the ideal companion to this process.

Weld or gouge—be SURE you do it with the 500-amp WS because, in addition to the natural advantages of a hermetically sealed, high capacity, silicon diode rectifier, it affords threefold protection.

Three automatic protection features eliminate the need for special precautions by the operator. First: an exclusive surge suppressor circuit to protect against transient voltage spikes. Second: an integral transformer thermal switch that prevents overheating with prolonged use. Third: an exclusive time and current sensing

(Below) The gouge and the gouging.



CIRCLE 177 READER SERVICE CARD

designed specifically for arc-air gouging, too!

relay circuit that prevents damage from the above normal current or above normal duty cycle.

You benefit with greater production and fewer repair bills. What's more, you have a dual-purpose unit that can both weld and arc-air gouge, a welder you can count on to work whenever you need it.

You can get other Westinghouse WS units with the same ruggedness and reliability. Capacities: 200, 300, 400 as well as 500 amps for 230/460-volt a-c operation.

Want more information on the industry's newest, most versatile welder? Contact your nearest Westinghouse Welding Distributor . . . or write Westinghouse Welding Division, 4454 Genesee Street, Buffalo 5, New York.

J-10483

watch Westinghouse for new developments in welding!

YOU CAN BE SURE...IF IT'S **Westinghouse**

The new WS welder.

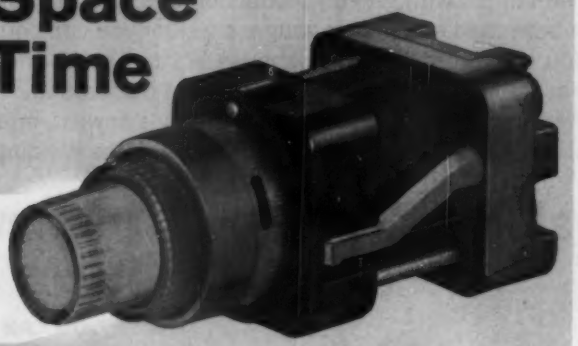
SEE . . . . the Westinghouse exhibit in Booth 115 at the American Welding Society Show. . . . April 26, 27 and 28.

CIRCLE 178 READER SERVICE CARD

...design leadership

Save Mounting Space and Installation Time *with this...*

ILLUMINATED PUSH BUTTON



- Push button and pilot light combined in one compact, oil-tight device
- Full heavy-duty contact rating
- Pressure connections eliminate internal wires
- Clearly marked terminals for easy wiring
- Button guard available to prevent accidental operation
- Full range of voltage ratings
- Choice of 6 color caps
- Same single-hole mounting as other oil-tight units

A *Complete* LINE OF OIL-TIGHT CONTROL UNITS

Write for Bulletin 9001-T Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin

SQUARE D COMPANY

wherever electricity is distributed and controlled

MORSE MAKES MILLIONS FOR PHILCO

. . . millions of tiny holes—precision-drilled by rugged, long-life Morse "Electrolized" Tools for Philco's fabulous Transac.

It's the world's first large-scale all-transistor computer – Philco's new Transac S-2000. Among its components: 18,000 printed circuit cards of epoxy resin glass fiber—highly abrasive, excessively wearing on the tools that have to drill hundreds of tight-tolerance holes in each card.

Philco uses the tools that are armored for rugged action: Morse "Electrolized" drills. More durable than high speed steel . . . more flexible than carbide . . . savers on down-time, replacement.

Morse will help you, too. Tell your cutting tool problem to your Morse-Franchised Distributor. He's the man with the answers.

MORSE

means "THE MOST" *in Cutting Tools*

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASSACHUSETTS

Warehouses in: NEW YORK • CHICAGO • DETROIT • DALLAS • SAN FRANCISCO

Morse means more production . . . smoother, more accurate production . . . with every type of cutting tool from drills, reamers, taps and dies, to end mills, milling cutters, slitting saws and "specials". So, if you want the best from every cutting tool you buy, mark your order "MORSE". For if you want *Morse Quality*, there's only one way to get it . . . *specify Morse.*

VN

A Division of VAN NORMAN INDUSTRIES, INC.

CIRCLE 180 READER SERVICE CARD

PIPE MACHINERY THREAD GAGES

As a precious stone is carefully cut and polished by an expert jeweler—so every Pipe Machinery thread gage is painstakingly lapped by experienced craftsmen to remove soft grinding skin, fat end threads and to produce a low micro finish.

Modern inspection facilities assure rigid operator control during every step of this important lapping process . . . assure a finished product of uniformly high quality with built-in wear life second to none.

When you purchase a Pipe Machinery thread gage, you can be certain the best in material, the best in equipment and the best in human skill have gone into its manufacture.

Write today for further information on our complete line of gages.

THE PIPE MACHINERY COMPANY • 29100 Lakeland Boulevard • Wickliffe, Ohio • Greater Cleveland

CIRCLE 181 READER SERVICE CARD
CIRCLE 182 READER SERVICE CARD ►

LINE BORING

STUB BORING

COUNTERBORING

ANGULAR BORING

FACE MILLING

END MILLING

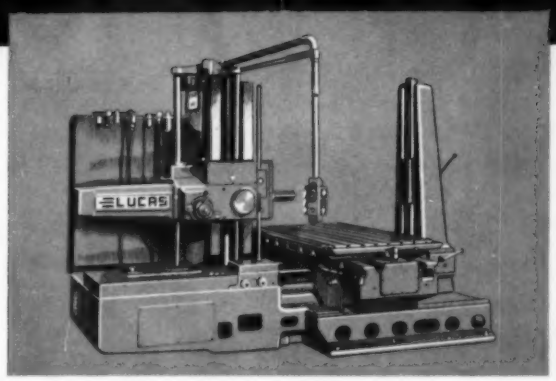
ANGULAR MILLING

DRILLING

REAMING

TAPPING

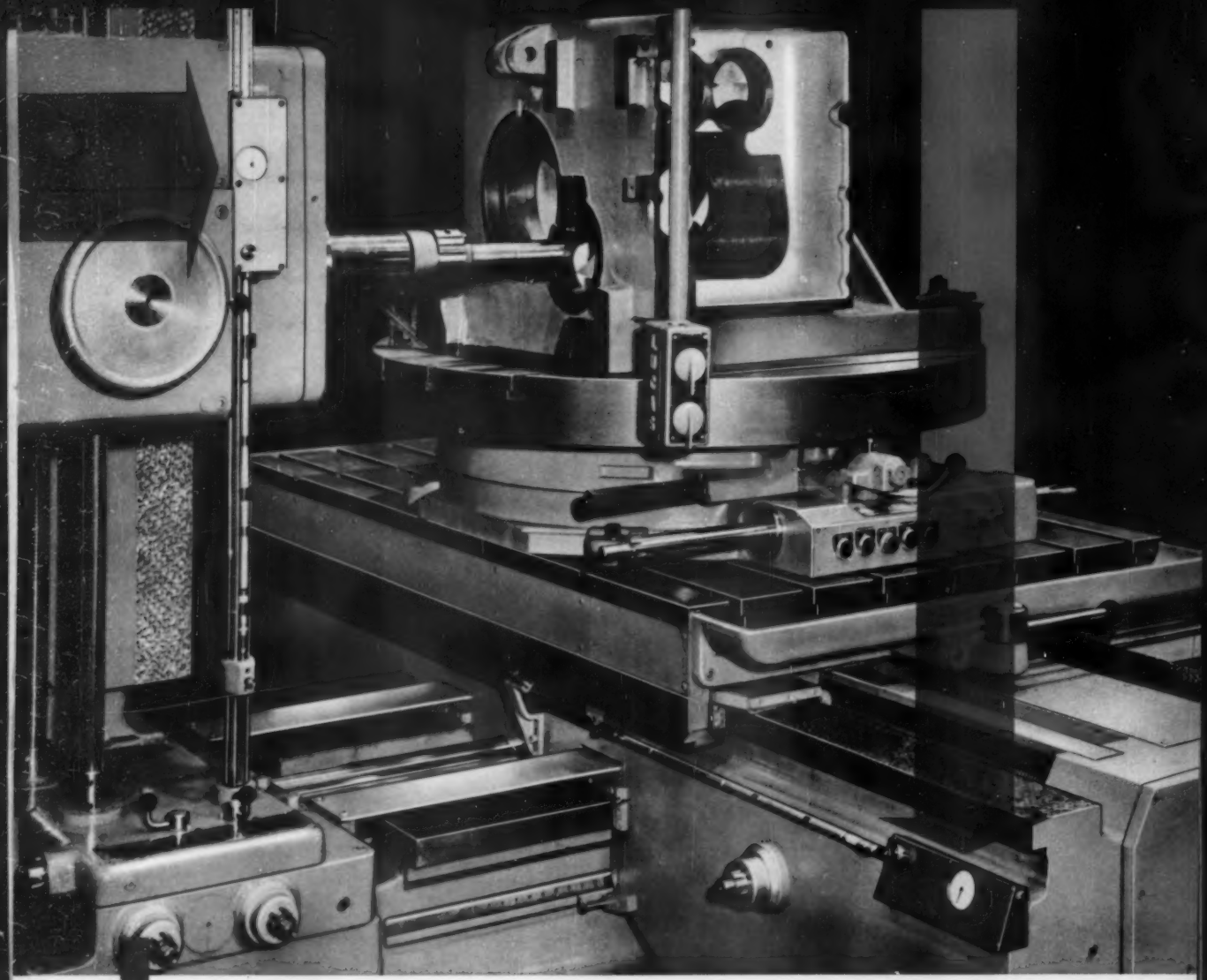
THREADING



Automatic power positioning with Lucas precision

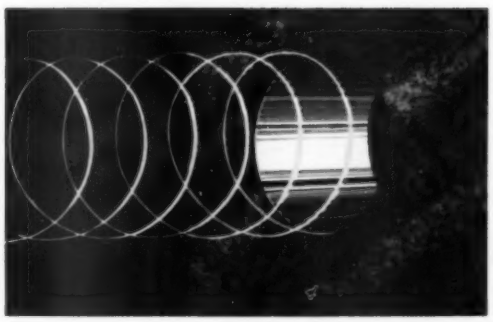
For production or faster completion of a single piece: locates head and table to predetermined settings for boring operations. No time wasted on jigs or fixtures in drilling, reaming and tapping. Lucas versatility, precision and time saving are the keys to Lucas profitability. Lucas Machine Division, The New Britain Machine Company, Cleveland, Ohio.

LUCAS
OF CLEVELAND



Automatic repeat settings accurate to ± .0001

Lucas Automatic Power Positioning operates at rapid traverse to locate head and table, entirely independent of operating feed rates—thru a system of end measuring rods and micrometer dial indicators. Upon starting the positioning cycle the machine does the precision setting automatically. Would you like a complete Lucas Catalog? Lucas Machine Division, The New Britain Machine Company, Cleveland, Ohio.



LUCAS
OF CLEVELAND

"Moto-Mower is Made of Only the Finest Materials . . . That's Why We Use Sharon Quality Blade Steels"

REUBEN SMITH, Inspector, MOTO-MOWER, Inc.
Subsidiary of DURA Corporation

"Here at Moto-Mower quality is not just a word . . . it's the goal," says Reuben Smith, Moto-Mower inspector. "To achieve this goal we have to be sure every component meets our rigid standards. I've found we can really depend on the quality cutting blade steels we get from the *Sharon Steel Corporation, Sharon, Pa.*"

SHARONSTEEL **SHARON** *Quality* **STEEL**

CALCULATED TO CUT COSTS

Every CARD tap is duplicated with geometric precision, in each type and size. This exact duplication brings valuable production benefits to every user. Make sure you get them by specifying CARD taps from your CARD Distributor. He has the taps, dies, gages and screw plates you need. For expert aid in selection and use, see your CARD technical man. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

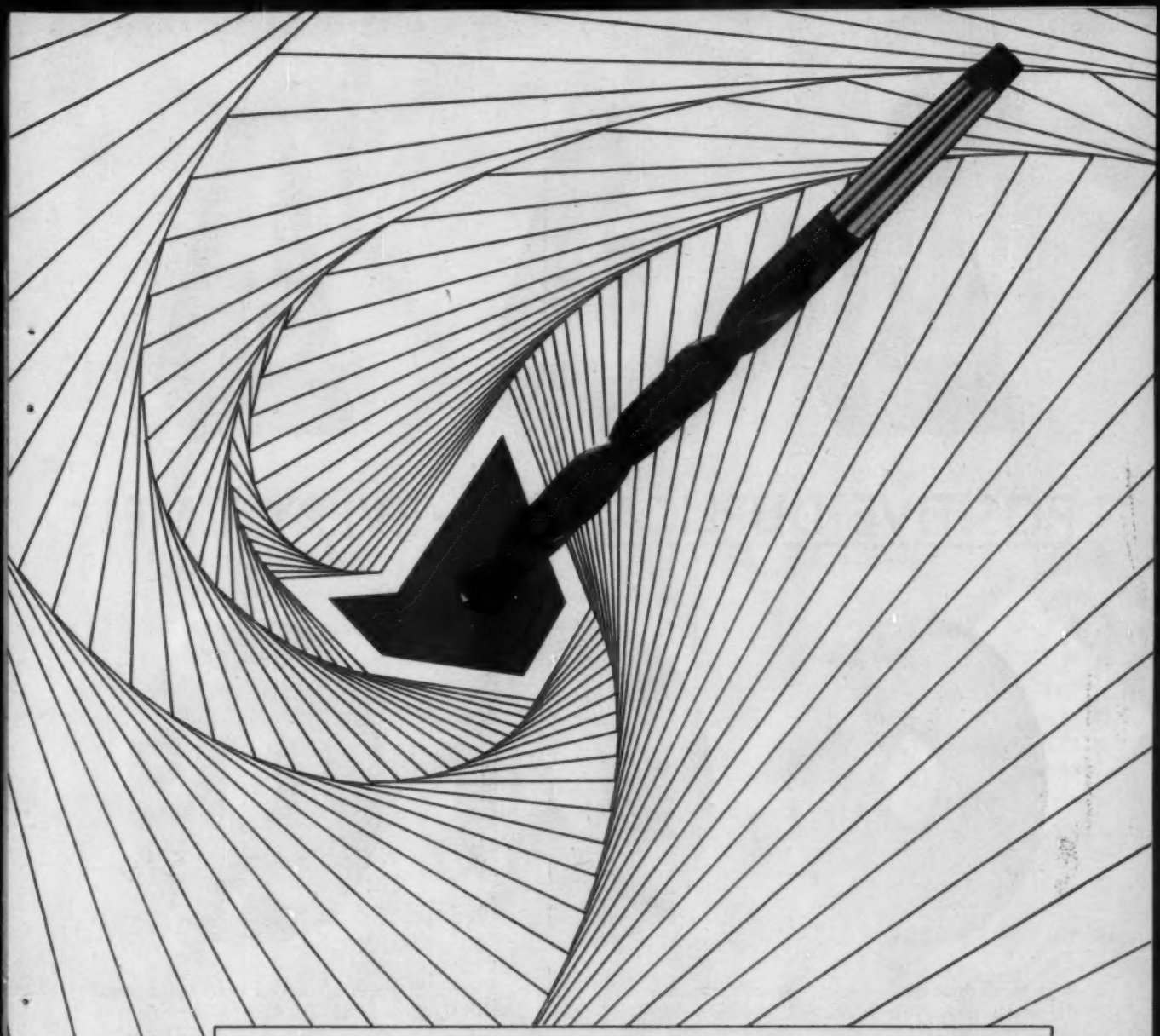
CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast

36C.0.3

CIRCLE 185 READER SERVICE CARD



GEOMETRIC PROGRESSION STABILIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

A truly geometric pattern is followed in precisely duplicating each UNION cutting tool, according to type and size. In your plant exactly duplicated UNION drills will protect product quality and aid in reducing drill consumption. For high volume, high quality production, specify UNION drills, reamers, milling cutters, end mills, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco.

UTD

UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts

S. W. Card Division, Mansfield, Mass. Butterfield Division, Derby Line, Vt.

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POSITIVE DUPLICATION—EVERY TIME!

With these three metronomes—or with a thousand—the time interval you choose can be positively duplicated time after time after time. And with these three PD® surface wheels—as with *all* CINCINNATI PD GRINDING WHEELS—you'll get the same kind of Positive Duplication *every time*!

HERE'S WHY . . . IN 36 STEPS

There are 36 unvarying quality control steps in Cincinnati's unique PD manufacturing process. Right from the start with the choice of the "grains" that go into a wheel, PD procedures involve exacting checks and re-checks. Every grain characteristic—from size, cleanliness, absence of foreign matter, color, magnetic content, to bulk density before and after blending—must fully satisfy extraordinary PD specifications, which are followed throughout in all 36 rigid controls.

RESULT: PREDICTABLE PERFORMANCE

You can depend on the uniformity of PD WHEELS—for each reorder wheel gives you exactly the same good job as the original. Production goes up and stays up. Costs go down and stay down. This is the promise—and performance—of Positive Duplication.

CALL CINCINNATI TODAY

Solve your grinding problems with the help of our Cincinnati-trained specialists. Their wide experience in job set-ups and grinding operations is at your service. Just call your CINCINNATI PD GRINDING WHEEL Distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

PD POSITIVE DUPLICATION

CINCINNATI®
GRINDING WHEELS

*Trade Mark Reg. U. S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

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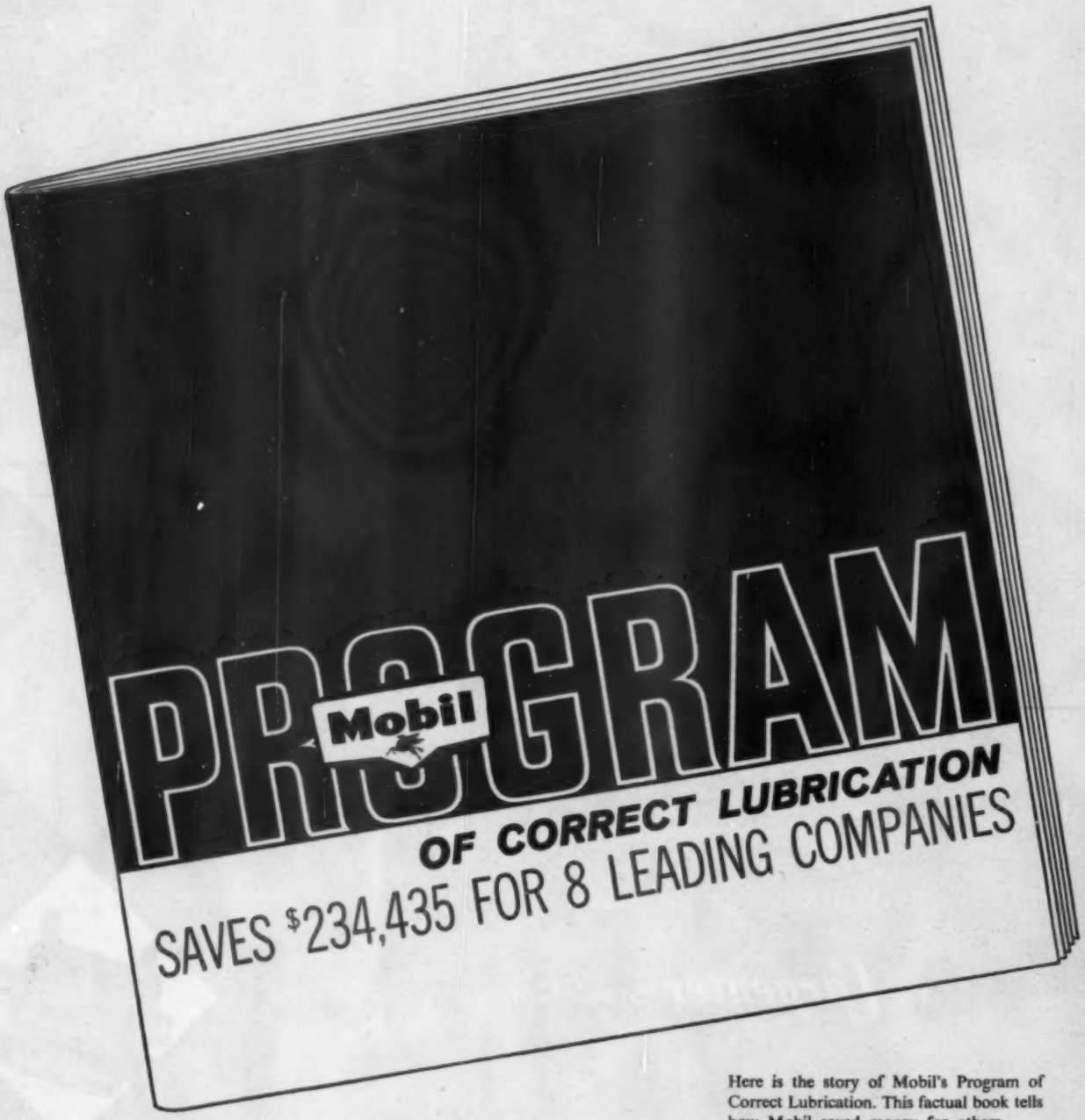
(A.I.S.I. Type A-6) free-machining, air-hardening tool and die steel moves every job from start to finish with exceptional speed, simplicity and safety. It is tougher, hardens deeper and is less sensitive to overheating than other air-hardening grades including A-4 types. No other air-hardening steel resists size change and distortion so dependably, or is so easy to machine. And only Carpenter Vega-FM, produced by MEL-TROL®, assures such overwhelming uniformity. Call your Carpenter SERVICE-CENTER for prompt delivery.

the *Carpenter* Steel Company, Reading, Pa.

NEW TOOL



Here is the story of Mobil's Program of Correct Lubrication. This factual book tells how Mobil saved money for others . . . could save money for your Company.

MOBIL OIL COMPANY,

FOR PLANT ENGINEERS...

Here's a 24-page book telling how the Mobil Program of Correct Lubrication saved 8 leading companies $234,435. With this record of PROVED RESULTS you can offer your management team a uniquely effective approach to reducing maintenance costs!

The Mobil Program of Correct Lubrication is a *proved* method of reducing maintenance costs and eliminating production losses caused by machine downtime.

To help you discuss the Mobil Program with your Management, we have prepared a brochure which explains simply and straightforwardly what the Mobil Program *is*, how it *works*, and how it already has achieved *sizable savings* for some of the nation's leading companies. Savings, in fact, that in many cases exceed the total cost of petroleum products purchased from Mobil.

We suggest you discuss this book with your Plant Superintendent, Works Manager, or other key personnel. In addition, you may wish to go over it with your V.P. in charge of Manufacturing. It will demonstrate your interest in reducing costs through wise purchasing and, at the same time, it will introduce your people to a program that produces *results*.

We suggest you order your Mobil Program books immediately. Your books will be sent to you promptly, and any other assistance you might want will also be made available to you.

Mobil

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Mobil Oil Company, Room 2060-F
150 East 42nd Street, New York 17, N. Y.

Please send me_____copies of the Mobil Program of Correct Lubrication book. (We ask that each request be limited to 5 copies.)

NAME_____

TITLE_____

COMPANY NAME_____

COMPANY ADDRESS_____

CITY_____ STATE_____

Norgren MANUAL-DRAIN AIR-LINE FILTERS

maintenance is this quick... this easy!

6 Top of filter remains connected to air line.

5 Filter element is held on by baffle plate.

4 Baffle plate is easily unscrewed by hand.

3 Clamp ring has quick-opening spring clip.

2 Filter bowl is held on by clamp ring.

1 Drain cock is easily turned by hand to empty liquid.

No tools required! Fewer parts to handle!

Norgren Manual-Drain Air-Line Filters can be quickly and easily disassembled to remove the filter element for cleaning. No tools are required. There are only 4 loose parts to handle, and reassembly is simple...a quick, easy job for anyone.

As a result, a Norgren manual-drain air-line filter is faster and easier to service than any other make of filter. This adds up to a big yearly saving for you in maintenance time and money.

Norgren Filters give you top performance

in removing damaging solids and liquids from an air line. Available with transparent or metal bowls. ¼", ⅜", ½", ¾", 1" pipe sizes.

For further information on the money-saving features of Norgren manual-drain air-line filters or Norgren automatic-drain air-line filters, call your nearby Norgren representative listed in your telephone directory—
or WRITE FOR DESCRIPTIVE LITERATURE

Compare Norgren with other makes of air line filters!

MAKE	NORGREN	A	B	C	D	E
Loose Parts to Disassemble	4	9	16	13	6	12
Tools Required for Maintenance	NONE	Wrench	Wrench & Screw-driver	Screw-driver	Wrench	Wrench & Pliers
Tool Operations Required	NONE	2	10	16	2	4

C. A. NORGREN CO.

FOUNDED IN 1926 — 3436 SOUTH ELATI STREET, ENGLEWOOD, COLORADO

4602
CIRCLE 191 READER SERVICE CARD

ANNOUNCING

NEW GISHOLT 3F FASTERMATIC WITH *FeeDial* CONTROL

IN JUST 15 MINUTES!

...then set your tools and take your trial cuts. That's how fast and simple it is to set up the new Gisholt MASTERLINE 3F FASTERMATIC Automatic Chucking Turret Lathe!

Only 15 minutes to pre-select feeds, speeds and functions—Now the desired feed rate is individually selected for each tooling station by turning a dial control. Selection of spindle speeds and machine functions is equally fast—just flick toggle switches. You do it all in just 15 minutes.

Completely automatic—But your savings don't end with fast setup. The automatic cycle assures consistent quality at fixed production rates. Any operator, even a new man, can chuck the work, start the cycle and remove the finished part. He has ample time to handle another machine.

What's more fast setup makes the new 3F pay off big on machining small lots—25 to 50 pieces—as well as long production runs. Contact your Gisholt Representative, or write us.

Send for literature—Ask your Gisholt Representative to show you how this new 3F with *FeeDial* can cut costs on your work.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

MMT=PE

Turret Lathes • Automatic Lathes
• Balancers • Superfinishers • Threading Lathes
• *Factory-Rebuilt Machines with New-Machine Guarantee*

Investigate Gisholt's Extended Payment and Leasing Plans

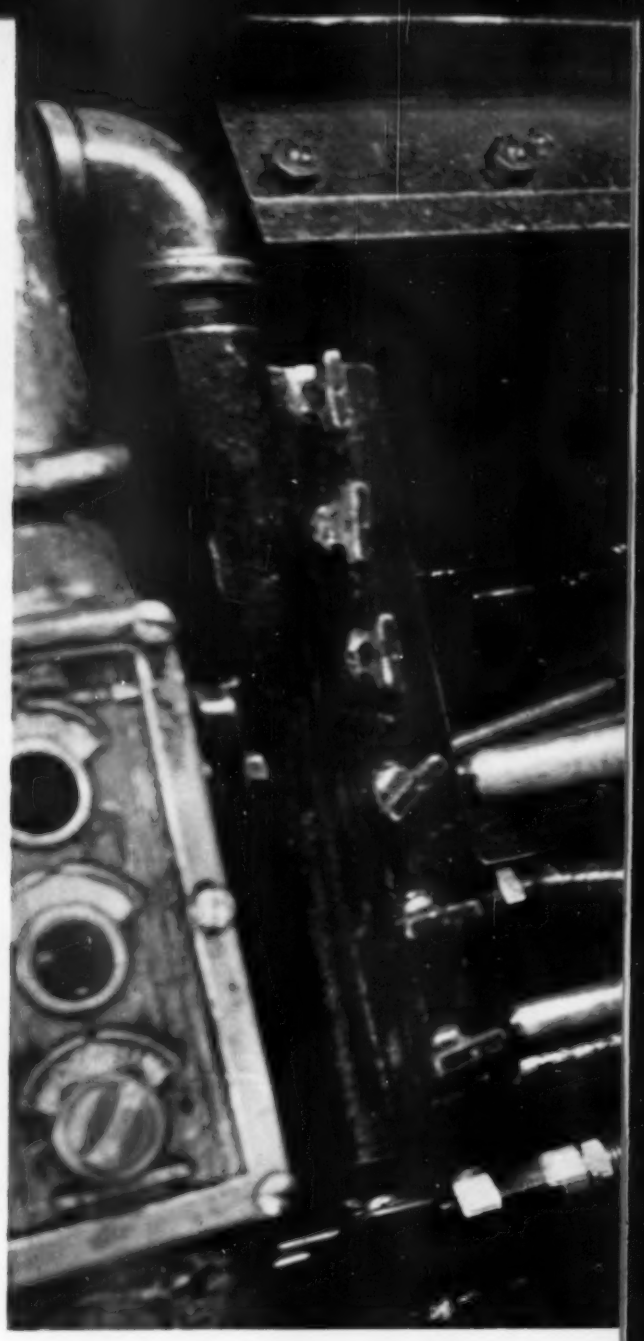
CIRCLE 192 READER SERVICE CARD

CIRCLE 193 READER SERVICE CARD ►

Irving Hunt, left, Secretary of Holt Products Company, and H. F. ("Herm") Johnson, Gulf Sales Engineer, discuss savings resulting from use of Gulfcut 31C.

Section of the modern automatic screw machine department at Holt Products Company, Holt, Michigan. Machining small precision parts, Holt gets superior results with Gulfcut 31C.

Job pictured here: cutting spacer blocks for plow manufacturer. Material: 1⅛" bar stock steel. Tolerances: ±.0005". Feed: .0006 ipr. Production: 340 spacer blocks per hour. Tool grinding required only once a shift. Finish: excellent.



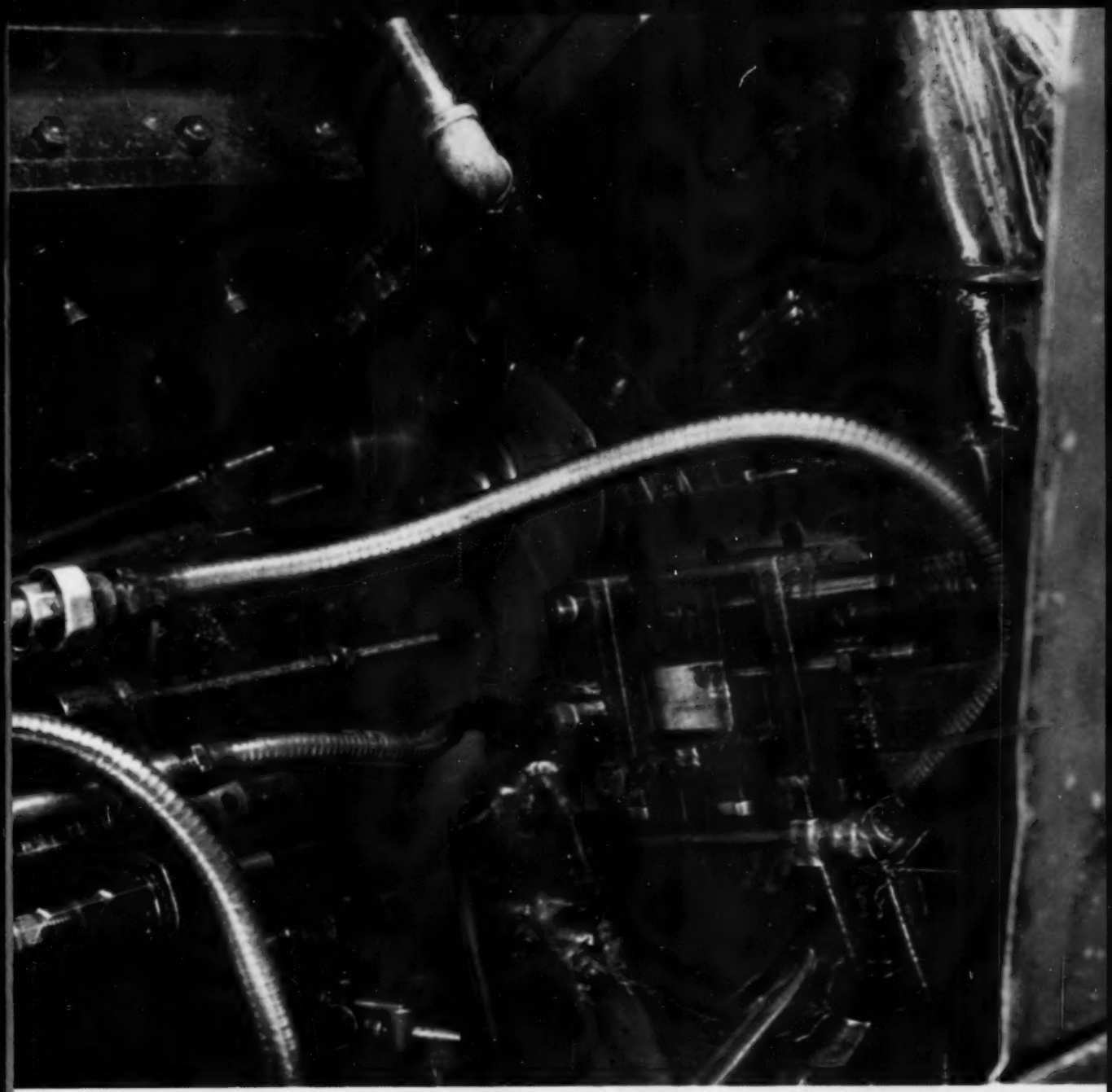
Replaces 6 oils with Gulfcut 31C, cuts machining costs 15%...

GULF MAKES THINGS

Three years ago, Holt Products Company, Holt, Michigan, producer of precision industrial, automotive and agricultural parts, was using six different cutting oils in automatic screw machine and turret lathe work. Here was a chaotic and costly inventory problem which Holt Secretary Irving Hunt was eager to eliminate.

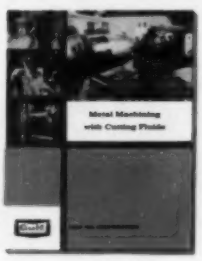
Acting on a Gulf Engineer's recommendations, Holt switched to just one cutting oil for all requirements. That one is Gulfcut 31C, a sulfurized mineral-lard oil possessing heavy load-carrying and anti-weld properties. Today, Mr. Hunt says, "Not only are we saving money by standardizing on this one superior cutting oil, but we are producing better work than ever, with few rejects. The increase in production and the longer life of our high-speed tools have meant a saving of at least 15% in over-all machining costs."

Perhaps some of your inventory and machining problems can be solved by one or more of the outstanding



RUN BETTER!

oils in the complete Gulfcut line. See for yourself how Gulf makes things run better! Just call a Gulf Sales Engineer at your nearest Gulf office. Meanwhile, send for your free copy of "Metal Machining with Cutting Fluids," the new 116-page handbook on their selection and use.

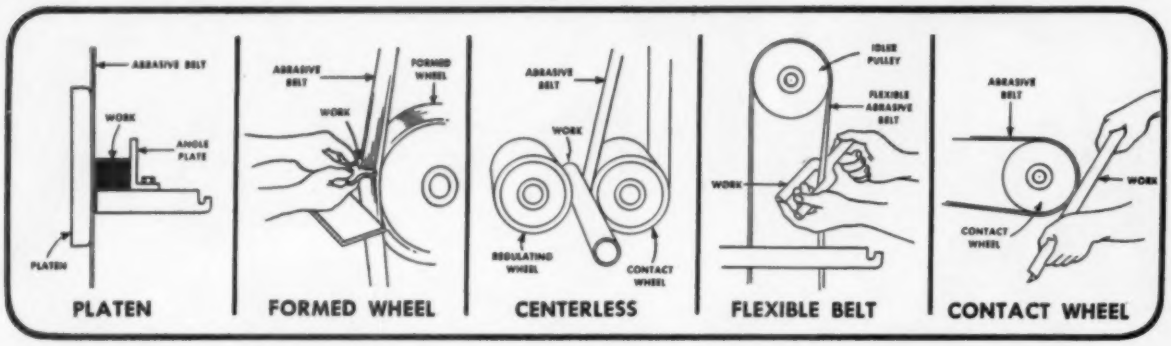


GULF OIL CORPORATION
Department DM, Gulf Building
Pittsburgh 30, Pennsylvania

GULF

SP-9785

BELT GRINDING: opportunity unlimited for faster finishing and metal removal



The opportunities for application of Sundstrand Engelberg precision abrasive belt grinders to improve quantity and quality of work are a stimulus to the imagination of creative methods men.

The belt grinding principle provides exceptionally rapid stock removal — up to three pounds of non-ferrous metal per minute! It speeds production and reduces costs because on most jobs it's from two to eight times faster. Setups are simple . . . tool dressing or grinding is eliminated . . . change-over takes but a few minutes . . . fixturing is simpler . . . and surface finish normally is markedly improved.

Wet and dry belt types are available for every requirement from toolroom work to automatic production of as high as 15,000 parts or more per hour.

A few of the many models of Sundstrand-Engelberg grinders are illustrated below. For more complete information, ask for descriptive literature.

Utility bench-type — used as contact wheel, flexible belt, or platen grinder.
Centerless wet belt grinder — for stock 1/16" to 2 3/4".
Centerless belt grinder — through-feeds both ways — for stock to 8 1/2" dia. — no limit on length.
Contour grinder-polisher — roughing and finishing — for hand- or fixture-held work.
Wet-dry belt grinder for mass production — 14,000 or more small parts per hour.
Multiple-head conveyor-type — rough grind to final polish in a single pass — any number of heads.
Wet-dry belt-type for platen or contact wheel grinding.
Rotary table platen-type — operator loads and unloads without interrupting production.

SUNDSTRAND ENGELBERG

SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • DIVISION OF SUNDSTRAND CORPORATION

◄ CIRCLE 194 READER SERVICE CARD

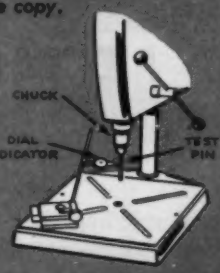
CIRCLE 195 READER SERVICE CARD

A
SHOP SUGGESTION
FROM
SUPREME

HOW TO TEST A CHUCK
FOR ACCURACY...

For fastest, most dependable service . . . order from your LOCAL Distributor

Supreme publishes an Engineering Catalog that gives exact information on testing a chuck for accuracy. This catalog defines and guarantees each Supreme Chuck's runout limits. *Write for your free copy.*



In the meantime, you can make an accuracy test by this method: Fit a hardened test pin into the chuck. Clamp a dial indicator to the machine so that its point touches the test pin an inch or more below the chuck. If runout is indicated, remove the chuck and repeat test on the arbor or spindle to determine the offending part.

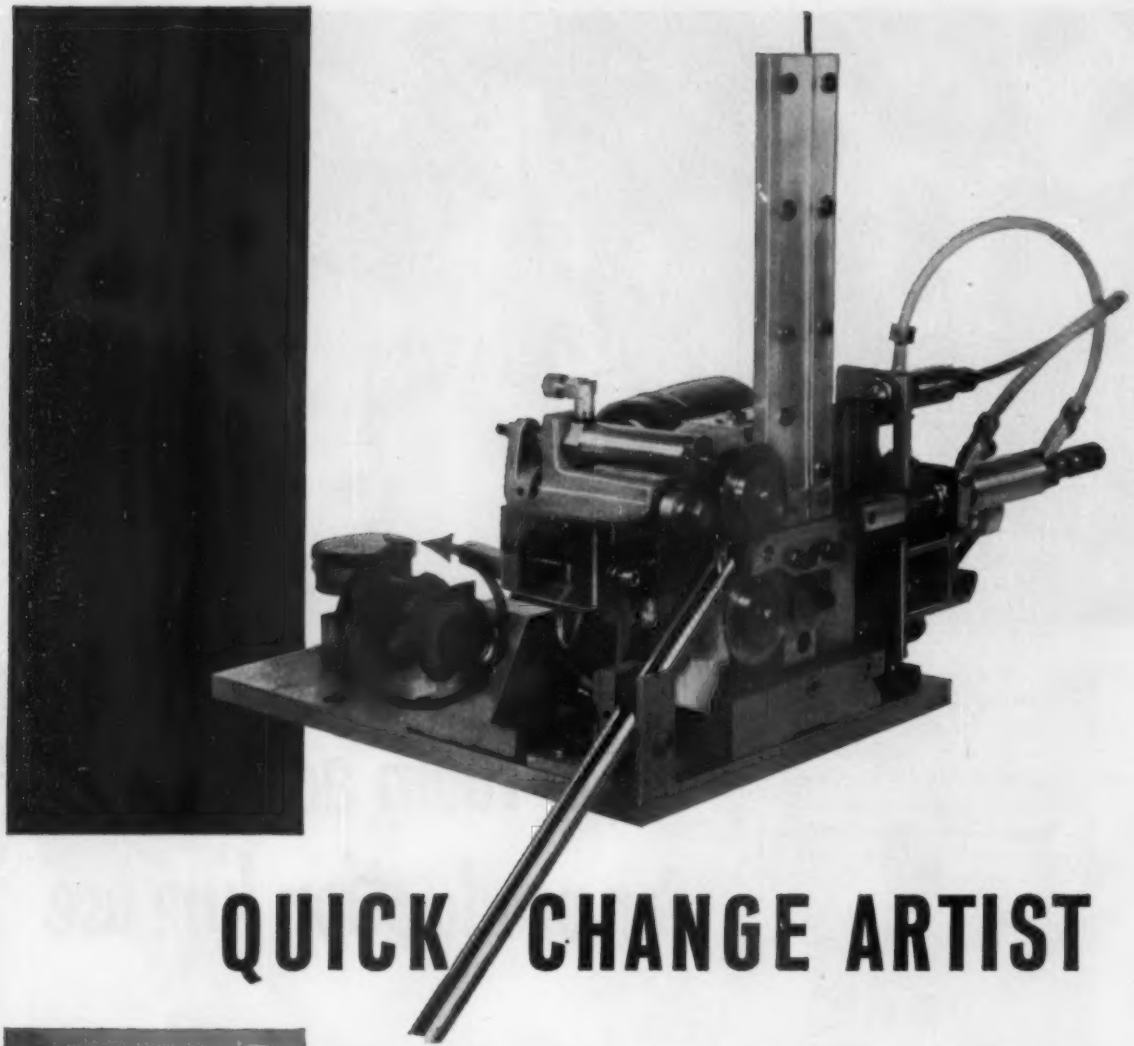
Dirt or chips in the chuck arbor hole can cause runout; so can bent spindles or loose bearings. *Look for the real cause.*

DIV. OF A·S·R PRODUCTS CORP.

Tool room accuracy for production line use

Supreme BRAND Chucks

SUPREME PRODUCTS CORPORATION
2222 SOUTH CALUMET AVENUE · CHICAGO 16, ILLINOIS



QUICK CHANGE ARTIST

Here's "packaged tooling" for internal grinding that's really versatile. With the turn of a single knob, fixtures can be interchanged to permit rapid set-up away from the machine. Production continues with hardly an interruption.

Quick change "packaged tooling" is only one of the many exclusive features of the Bryant Model "B" Centalign® — features which are helping manufacturers of miniature components establish new records for accuracy and production.

If you are grinding the bores or raceways in miniature bearings or similar parts, investigate the Bryant Model "B" Miniature Centalign. It will repay you in increased profits.

P.S. Space is no problem with the Bryant Miniature Centalign. It packs all its job-engineered features in only 8¼ square feet.

BRYANT Chucking Grinder Co.

85 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Springfield, N. J. • Cleveland • Detroit • Indianapolis • Chicago • Los Angeles

Internal Grinders • Special Machinery

NEW: "Big" drilling jobs made easy

Delta 20" Drill Press, also 17", 15", 14" and 14" Super-Hi Sensitive. Available in floor, bench and multiple spindle models.

This custom "radial drill" is provided by combining standard Delta drill press components—an 8-ball bearing traveling carriage, husky 33" column, raising mechanism and choice of four Delta 20" drill heads. Suspended from an overhead trackway, it swings to any position over the work—handles jobs too big for conventional drilling, in production runs too small to justify an expensive machine tool.

But whether your production requirements call for special set-ups or standard tooling, you'll find that Delta drill presses offer you money-saving versatility and precision performance under the most rugged work loads. Delta drill presses have set the industry standard for years because they cost less to buy, operate and maintain.

Choose from the world's most complete drill press line—visit your Delta Industrial Distributor (listed under "TOOLS" or "MACHINERY" in the Yellow Pages). For FREE Delta Industrial Catalog showing 61 machines, 302 models, over 1400 accessories, write: Rockwell Manufacturing Company, Delta Power Tool Division, 618D N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ontario.

DELTA INDUSTRIAL TOOLS
another fine product by
ROCKWELL

Visit Delta in Booth No. 2046 at the A.S.T.E. Show

CIRCLE 198 READER SERVICE CARD

A ROOMFUL of THOMPSON GRINDERS

This is the eighth Thompson grinder recently installed at Jessop which grinds plates and sheets up to 60" × 96" in size.

Jessop precision ground flat stock which is used in gages, dies, verniers and other exacting products.

Pictured above are 4 Thompson Grinders in the Specialties Division of Jessop Steel Company, Washington, Pennsylvania. There are 4 more Thompsons which are not shown in the above photo. All these Thompson machines are grinding to the extremely accurate tolerances and fine RMS finishes that distinguish Jessop's precision ground flat stock.

There are excellent reasons for using 8 Thompsons on this essential production. Mr. Joseph Manfredi, who is responsible for the quality and production of this famous ground flat stock, says, **"We have recently installed our eighth Thompson grinder in this division. We have proven the top performance of these rugged machines for many years. They give us the extreme accuracy and precision we demand—day after day with a minimum of maintenance."**

You may not need 8 Thompson grinders in your operations but it will pay you well to investigate what just one Thompson machine can do toward saving time, improving your products and cutting your costs of manufacture.

Your inquiries are invited.

MMT·PE

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO

"Keep Thompson in mind for that daily grind"

Thompson SURFACE GRINDERS

CIRCLE 198 READER SERVICE CARD

Another addition to the famous "Greenfield" Line . . .

Greenfield

Tru-Lede

Fluteless Taps

Patent No. RE. 24572

FOR

PRESSURE FORMING

INTERNAL THREADS

IN

COPPER

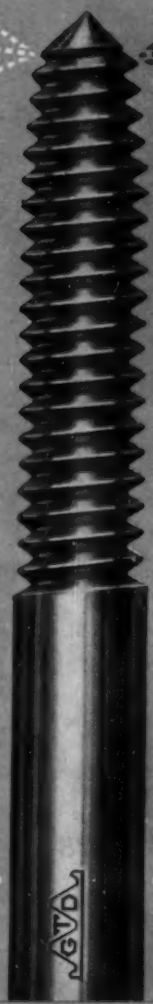
BRASS

ALUMINUM

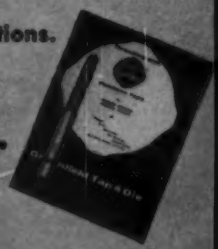
DIE CASTINGS

LEADED STEELS

and other ductile materials



TRU-LEDE fluteless taps do not cut threads in the same manner as conventional taps. Actually they are a forming tool and their action may be compared with *external thread rolling.* No problem of chip disposal as there are no chips with this method. Under proper conditions and in the appropriate materials, they are giving outstanding results in hundreds of applications.



Ask your GREENFIELD Distributor for a copy of this 4-page pamphlet. It contains the complete story: Sizes available, recommended limits, selecting the right tap drill, and other information you'll want to have.

A Greenfield field engineer is available to talk over your tapping requirements and to discuss how TRU-LEDE TAPS can help you. CALL HIM THROUGH YOUR GREENFIELD DISTRIBUTOR.

GREENFIELD TAP & DIE

GREENFIELD, MASSACHUSETTS

CIRCLE 200 READER SERVICE CARD

NATIONAL ACME'S

"ZONE OF RESPONSIBILITY"
INCLUDES ALL PHASES OF COST REDUCTION

Check YOURS...Then Check National Acme

Direct Costs: these include direct dollar savings as realized by Minneapolis Honeywell . . . an "every day" job for Acme-Gridleys.

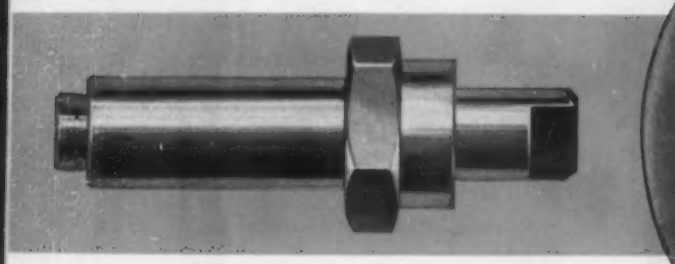
Indirect Costs: effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc.

Product Redesign: teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities.

Direct Material Costs: our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems.

Make-or-Buy Reviews: in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment.

Spot Modernization: pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.

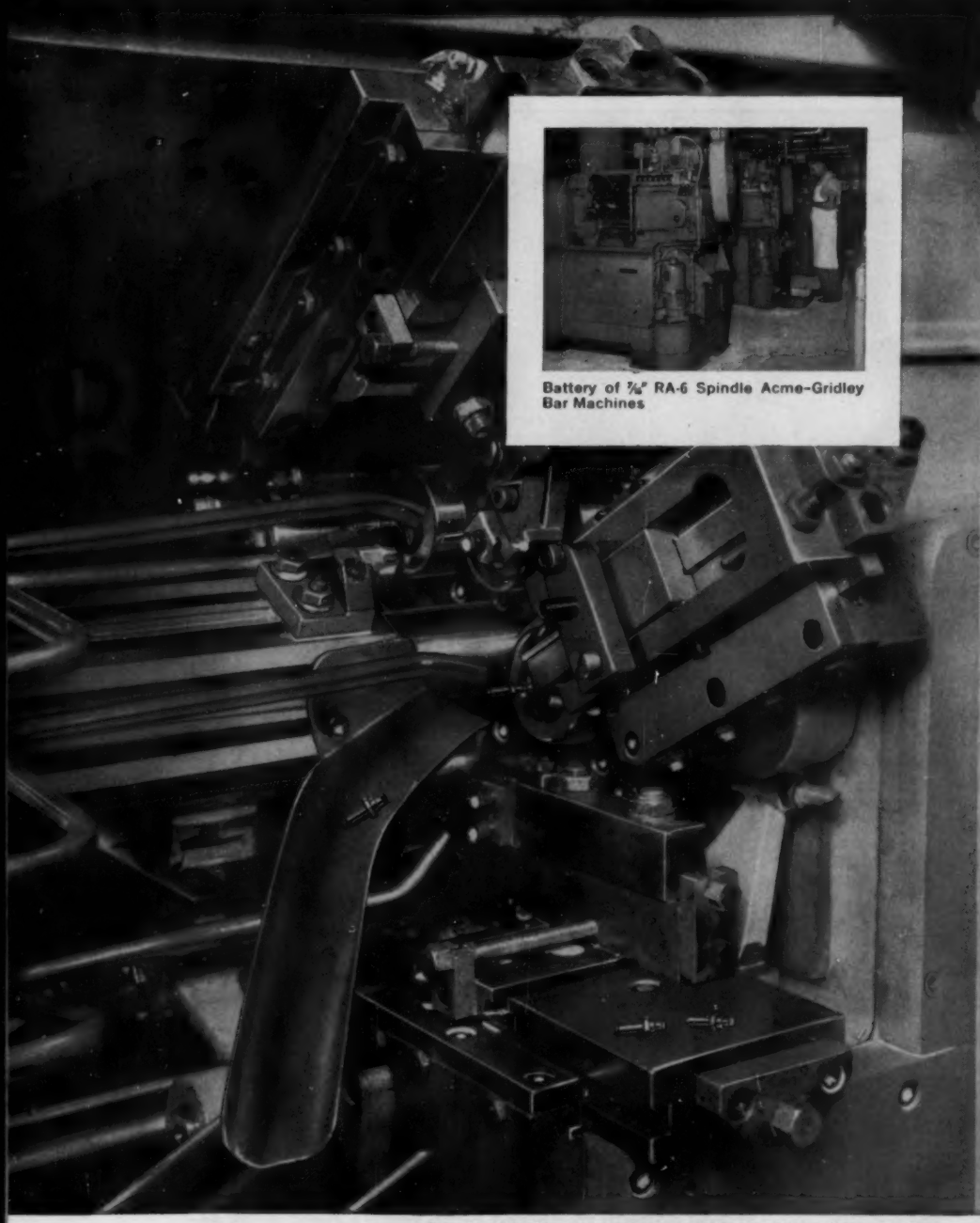


At Minneapolis Honeywell

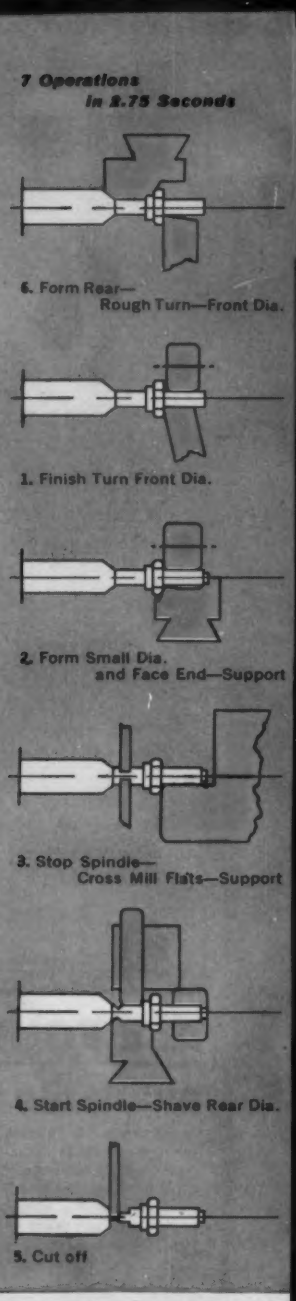
ONE ACME-GRIDLEY REPLACES FIVE SINGLE SPINDLE MACHINES

. . . Saves 80% in Machine Hours

CIRCLE 201 READER SERVICE CARD



Battery of ⅞" RA-6 Spindle Acme-Gridley Bar Machines

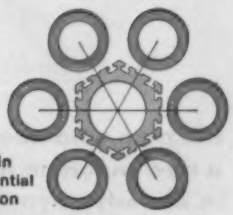


Close up of tooling zone showing 3rd, 4th and 5th position operations

. . . *in addition* the reject rate is reduced 83% and operator hours per thousand slashed 92% in the production of a precision center post component for residential thermostats. What's more, with one machine, one set of tools, and one operator doing all machining in the primary setup, quality control is greatly simplified, and valuable floor space saved. Still further savings result from greatly reduced machine maintenance.

Such drastic savings are possible for Minneapolis Honeywell because of inherent Acme-Gridley features such as independently operated tool slides, the extreme accuracy and flexibility of direct camming, and wide open tooling zones. Rugged and versatile 7/16" Acme-Gridleys fit right in with Honeywell's program of "Total Machine Utilization"; will pay off for years to come by economically accommodating the materials and setups Honeywell requires in the production of small, high quality parts for their precision instruments.

Get the complete story on how Acme-Gridley Automatics provide industry's most modern approach to cost reduction. Call, write or wire.



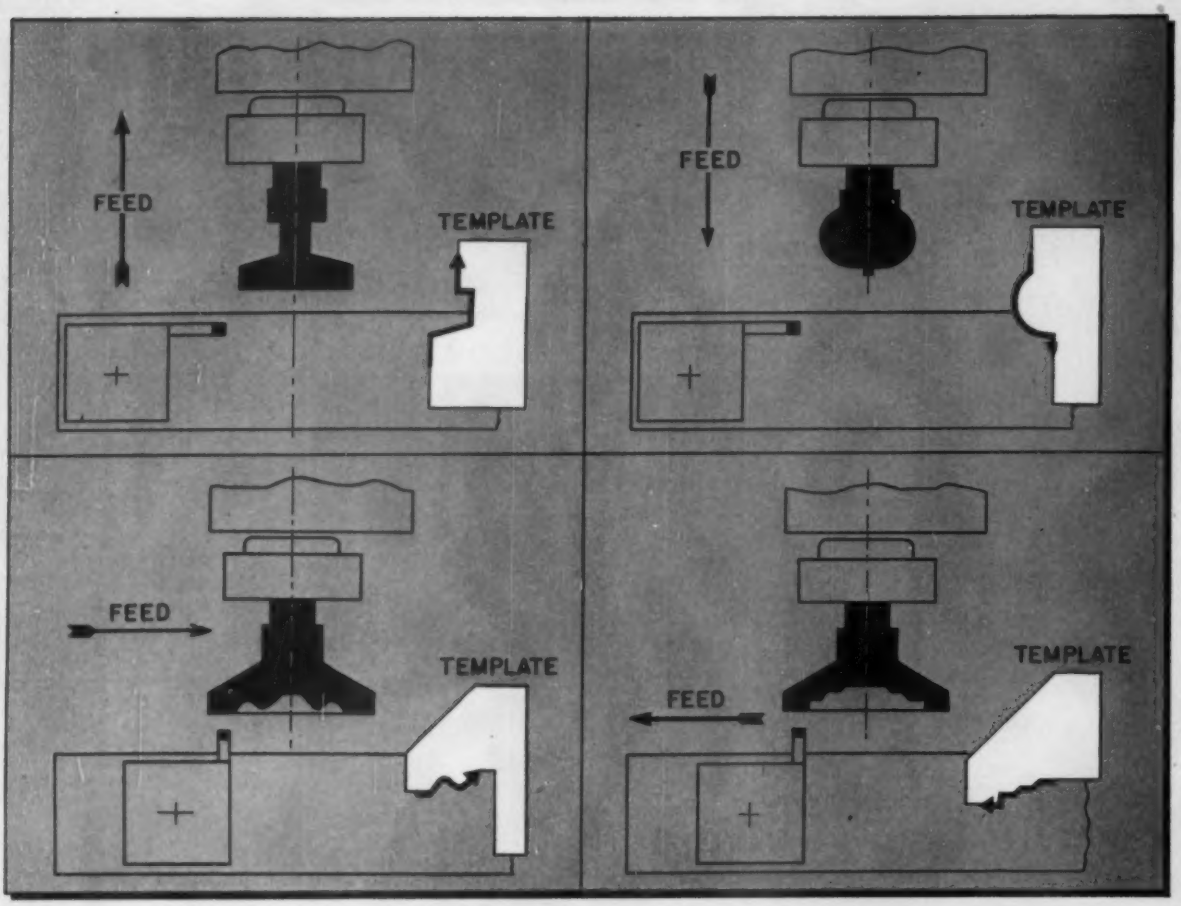
Pioneer in Circumferential Automation

National Acme

The National Acme Company
171 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N. J.; Chicago 6, Ill.; Detroit 27, Mich.

CIRCLE 202 READER SERVICE CARD



ALL FOUR of these Automatic Tracing Cycles are available with a SINGLE Jones & Lamson Turret Lathe

the man who needs a new machine tool is already paying for it

How's this for machine flexibility in one chucking? (1) You get all of the accuracy and tooling combinations offered by the standard J & L Turret Lathe. (2) You have more than 180° of tool travel control in each of four different automatic tracing cycles (you don't *have* to have *all* four, incidentally). (3) You do both rough and finish tracing (*with rough and finish tools*) in the same set-up. (4) You multiple-tool your tracing operations through 180° of tool control. (5) You have complete control for diameter with the conventional graduated hand wheel on either mechanical or *tracing* operations. (6) The original full swing of the Turret Lathe is retained with this tracer. (7) A single lever disconnects the tracer for standard turret lathe operation.

Such flexibility enables you to perform an amazing amount and variety of work with this new *Two-Dimensional Tracer* on J & L Saddle Type Turret Lathes.

It all adds up to: MAXIMUM WORK COMPLETED IN ONE CHUCKING; REDUCED HANDLING TIME; INCREASED ACCURACY. Write for further information.

JONES & LAMSON Machine Company • Dept. 710, 502 Clinton St., Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

AUTOMATIC PRODUCTION is faster, more accurate, more profitable

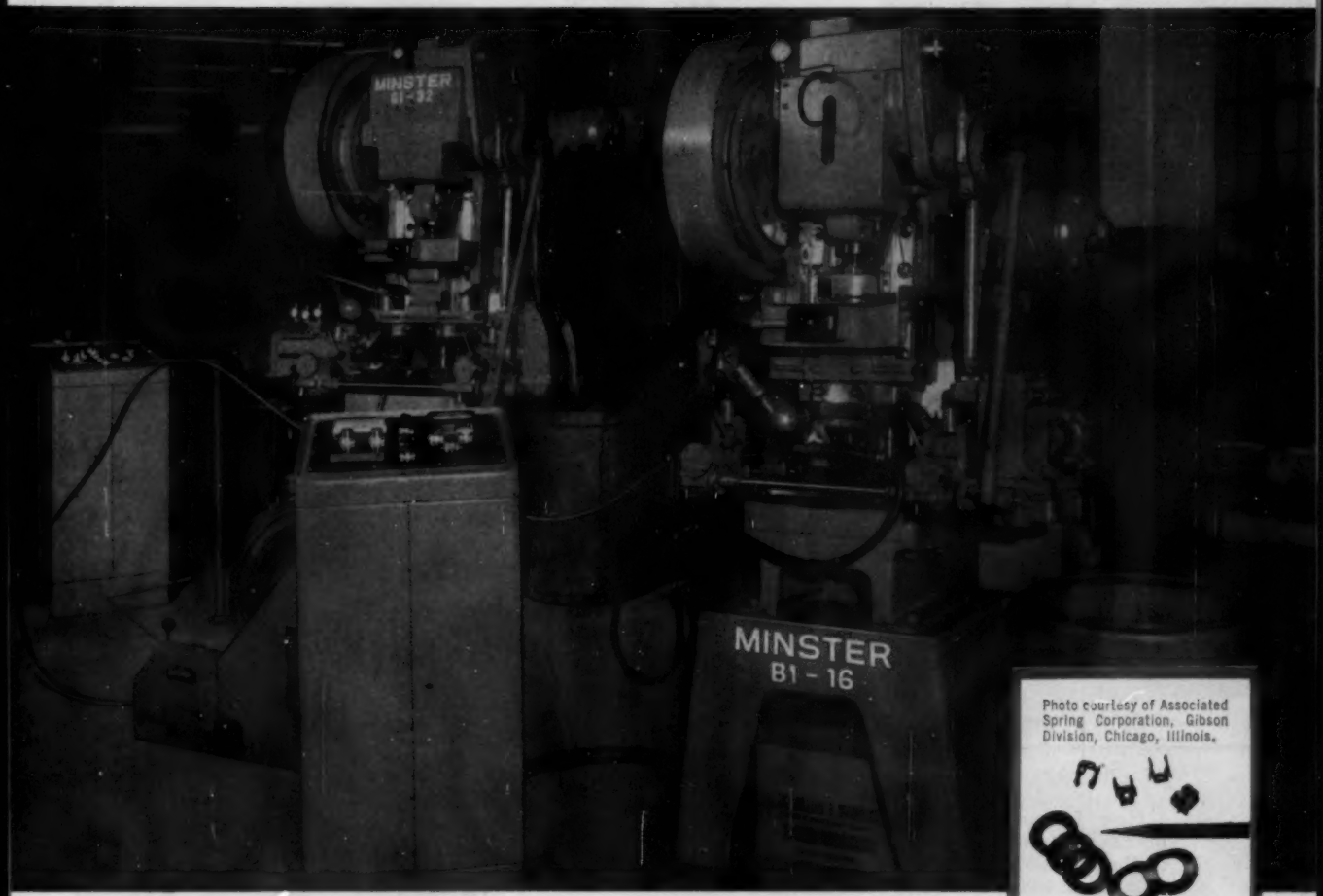


Photo courtesy of Associated Spring Corporation, Gibson Division, Chicago, Illinois.

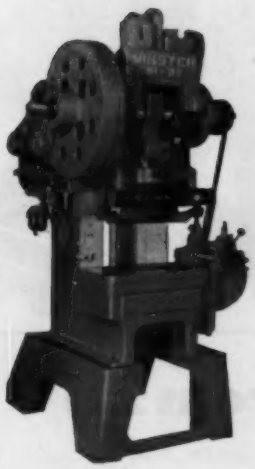
Minster B1 High Speed Gap presses range in capacity from 16 to 60 tons. They're compact and highly efficient for long or short run small parts production from coil stock.

Minster B1 High Speed Gap Presses

You gain in many ways when you run single or multi-stage jobs automatically at high speeds. You increase production and slash costs. Less equipment is needed, cost per part is lower and that means more profit.

Automatic production is always *most* profitable when you take advantage of Minster's technical knowledge and wide range of presses and feed equipment. Minster matches the proper type and size of press and feed to your requirements . . . gives you maximum versatility in material size and job selection.

Let us show you the best way to run your jobs automatically—at greater profit. Write or call today.



The Minster Machine Company • Minster, Ohio

MINSTER®

CIRCLE 204 READER SERVICE CARD

NOW you get greater opportunity for profit, serve customers better with JOHNSON *Continucast** 105" bronze bars

Now famous Johnson quality solid and tubular bronze bars are being produced by a continuous casting method in 105″ lengths to enable you to increase your profits and to better serve your customers.

The new **CONTINUCAST** bars give you greater freedom of range for cutting to customers' requirements since you can cut this long bar in multiples of a variety of lengths with less waste. Inventory is also simplified.

You can now offer your customers improved quality at competitive prices because the continuous casting method improves the physical qualities of the Johnson alloy 72 (SAE 660). The distribution of lead and other elements is more uniform. This improves machinability, makes for longer tool life. **CONTINUCAST** bars also provide greater tensile, yield, impact and fatigue properties.

Johnson **CONTINUCAST** 105″ Bronze Bars are available in 21 sizes of solid bars from ½″ to 3″ in diameter, and in 118 sizes of tubular bars which range from ½″ to 2½″ ID and from 1″ to 3″ OD.

It will pay you to stock a complete range of Johnson **CONTINUCAST** Bronze Bars — be ready to serve your customers and enjoy the increased volume of profitable business made possible by this new line.

**Trademark.*

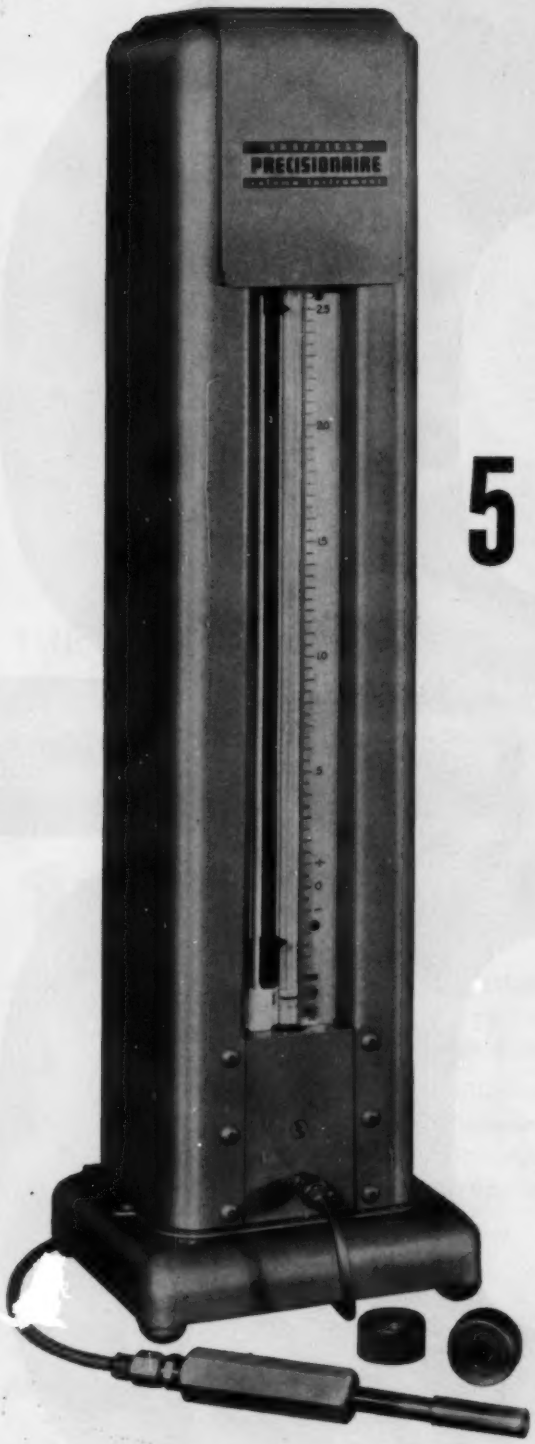
JOHNSON Bearings

Johnson Bronze

515 South Mill Street • New Castle, Pa.

Subsidiary: Apex Bronze Foundry Co., Oakland, Cal.

CIRCLE 205 READER SERVICE CARD



New Long-Range 15″ Precisionaire® Column Instrument Now backed by

5 Year Warranty

For all cost-conscious gage buyers, Sheffield's new 5-year Quality and Reliability Warranty on Precisionaire Column Instruments shipped with Sheffield gaging tooling is important news. In addition, 15″ Precisionaire Column Instruments are now supplied in multi-column models, with 5000 to 1 and 10,000 to 1 amplifications. (Higher amplifications up to 100,000 to 1 obtained with Super-Amp Package.)

This instrument doubles gaging range, cuts initial gage cost, reduces gage inventory and upkeep.

You can inspect wider part tolerances at higher amplification with greater accuracy and speed.

You can classify parts into more size increments with a wider scale spread for each class—fewer borderline cases.

You can better control in-process gaging because of greater approach or "come-up" range.

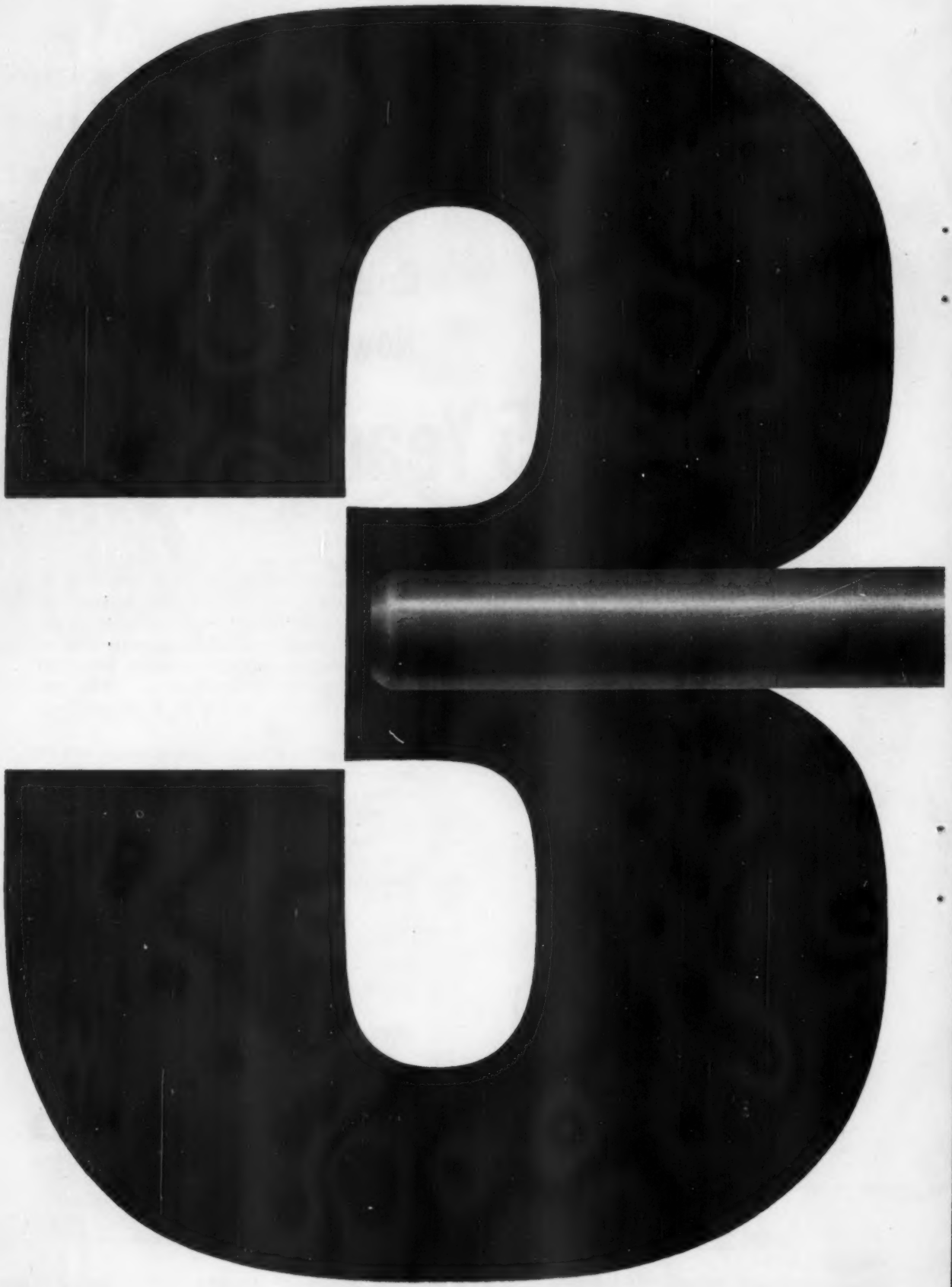
Amplification of Plunjet® gaging cartridges is doubled and full amplification is obtained when gaging small diameters.

Call your local Sheffield representative for a demonstration or write Dept. 1.

The
SHEFFIELD
Corporation *Dayton 1, Ohio*

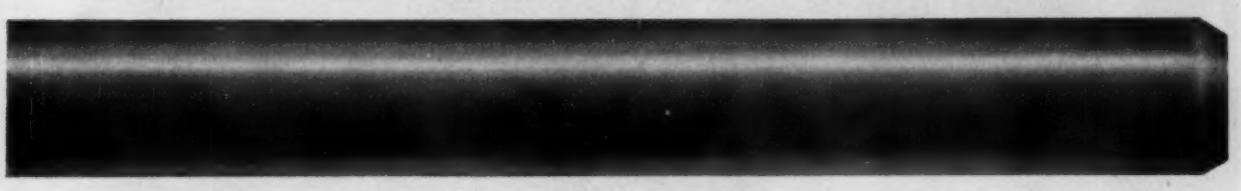
A subsidiary of The Bendix Corporation

Gages, Measuring Instruments, Automatic Gaging & Assembly Systems • Machine Tools • Contract Mfg.



3 NEW ADVANTAGES YOU GET WITH **MICRO-CHIP**

THE NEW KAISER ALUMINUM 2011-T3 SCREW MACHINE STOCK



1 **PROCESSED FOR EASIER MACHINING** • Micro-Chip is alloy 2011-T3 stock produced by a unique process that improves machinability—gives finer, smaller chips. Speeds your production . . . saves wear on your equipment.

2 **BOTH ENDS OF BAR CHAMFERRED (Most sizes)** • Now you can feed either end of the bar into the machine! Eliminates extra handling and awkward flip-flopping, and reduces feed finger wear. Comes in 12-foot lengths, up to 3-inch diameter and 2-inch hex in standard 200-pound packages.

3 **NEW BRIGHTER, CLEANER SURFACE** • Automatically gives the parts you produce an improved finish in areas where no stock is removed. Permits cleaner handling in your shop . . . saves you finishing time and work . . . may allow you to make lower bids.

KAISER ALUMINUM

*TRADEMARK OF KAISER ALUMINUM & CHEMICAL CORPORATION

THIS LABEL IDENTIFIES MICRO-CHIP • Kaiser Aluminum Micro-Chip is now available through Kaiser Aluminum and Kaiser Aluminum Distributors—**at no extra cost.** Ask for it by name and look for this label.

BRIGHTER CLEANER

MICRO-CHIP

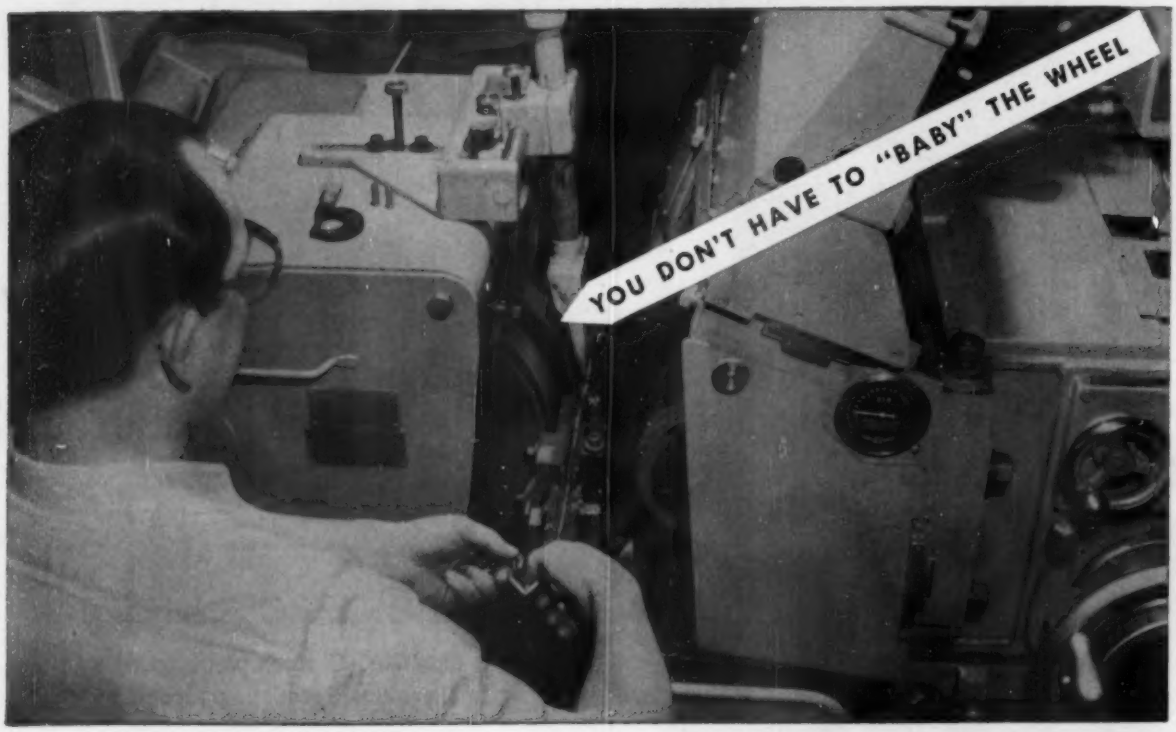
2011-T3

Kaiser Aluminum & Chemical Sales, Inc., 300 Lakeside Drive, Oakland 12, California

See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult local TV listing

Why General Electric Man-Made diamonds are better for you

HEAVY-DUTY WORK?
G-E Man-Made diamonds can take it!



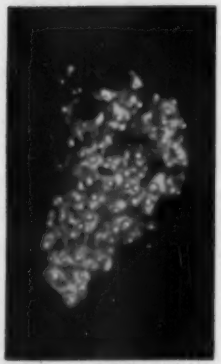
RVG diamonds—with optimized crystals—have built-in qualities that make them superior in wheels for all resinoid and vitrified grinding.

If yours is a heavy-duty grinding operation, wheels containing G-E Man-Made diamonds can take the punishment – and then some! Here's why:

General Electric has improved the crystal characteristics of its Man-Made industrial diamonds for resinoid and vitrified grinding (designated as type RVG). Manufactured under controlled conditions, G-E Man-Made diamonds are of optimum friability and shape to cover wider applications – everything from machining single-point tooling to grinding carbide-and-steel mixtures (even up to high ratios of 50-50!).

And because G-E Man-Made diamonds are irregular blocky crystals with rough surfaces, they stay bonded longer . . . so, you get more mileage per wheel. Wheels containing General Electric Man-Made industrial diamonds are available in ample supply to meet your needs.

Have you looked into the advantages of grinding wheels containing General Electric Man-Made diamonds lately? Better talk it over with your grinding wheel supplier today. *Metallurgical Products Department of General Electric Company, 11149 E. 8 Mile Street, Detroit 32, Michigan.*



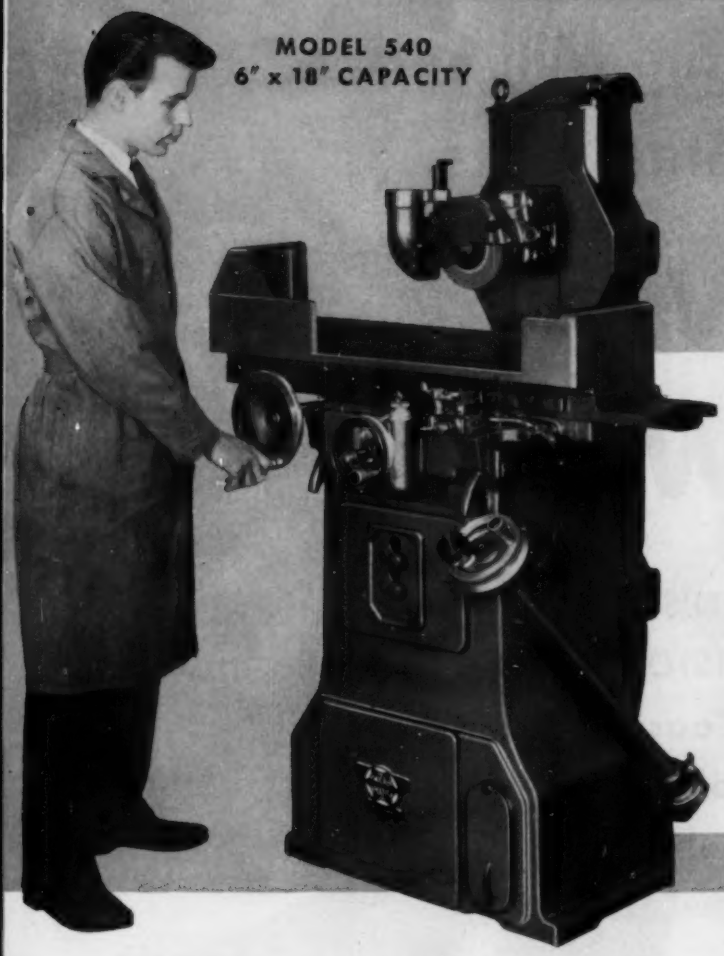
G-E Man-Made industrial diamond (enlarged approximately 140 times) with optimized crystal characteristics can be used in wheels for every resinoid and vitrified grinding operation.

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMONDS • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

HYDRAULIC SURFACE GRINDER



MICRO MATIC HONE CORPORATION DETROIT MICHIGAN

MANUFACTURED BY JONES-SHIPMAN LEICESTER, ENGLAND

ACCURACY... EFFICIENCY... EASE OF OPERATION

This machine has all the essential qualities required to provide high caliber surface grinding. Its simplicity of design provides ease of operation while inherent accuracy and efficiency assure excellent grinding performance. Thousands of these grinders have been purchased by discerning users in every part of the world.

FEATURES:

- Completely centralized controls within easy reach of operator.
- Patented low-pressure, long-life Hydraulic System operating from self-contained motor-driven pump unit.
- Table traverse rates variable from 5′ to 40′ per minute. Smooth and shockless reversing at maximum speeds.
- Cross-feed automatically variable from .01 in. to .07 in. per stroke.
- Hand controls provided for both traverse and cross-feed. Micrometer adjustment to cross-feed in .0001 in. divisions.
- Vertical adjustment of wheelhead controlled by conveniently placed handwheel having a micrometer knob adjustment in .0001 in. divisions.
- Wheelhead slide operates on ball bearing rollers running on precision ground bars providing absolute sensitivity of vertical feed.

Automatic vertical wheelhead feed and electric lift can be fitted to standard machine as an extra feature. Also, numerous other attachments including form tool grinding equipment are available to assure full versatility.

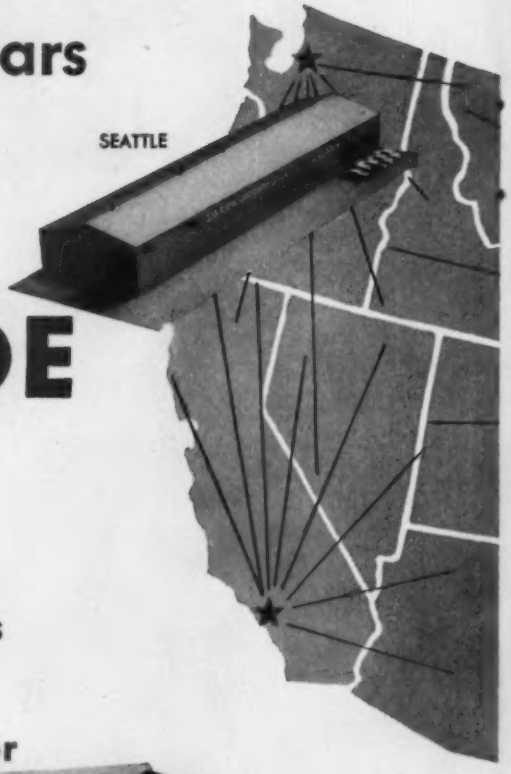
FOR FURTHER INFORMATION, WRITE FOR YOUR COPY OF BULLETIN C183.

PRECISION PRODUCTION THROUGH RECONDITIONING — MICRO MATIC

MICROMATIC HONE CORP.

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

The Industry's Most Complete and Most Flexible Mill Service For Cold Finished Steel Bars



NOW... NATION-WIDE

BLISS & LAUGHLIN'S new SIERRA DRAWN DIVISION adds two West Coast mills to provide a full range of cold finished steel bars for all metalworking areas

The merger of Sierra Drawn Steel Corp.'s Los Angeles and Seattle mills with Bliss & Laughlin's four midwestern and eastern mills expands Bliss & Laughlin's fast, flexible, specialized production facilities all across America.

Sierra Drawn joins Bliss & Laughlin to bring a complete line of cold finished steel bars to the growing West Coast metalworking industry. Bliss & Laughlin looks to its new Sierra Drawn Division as a respected partner in enlarging the company's present West Coast services.

This extension of Bliss & Laughlin's production skills across the nation is another step in company's seven decades of leadership in providing the industry's *most complete* and *most flexible* mill service.

Completes Another Step In Bliss & Laughlin's Nearly 70 Years of Leadership In Production Methods, Research and Service

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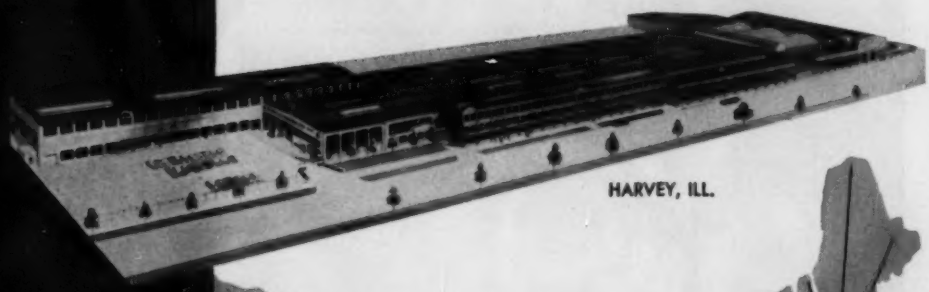
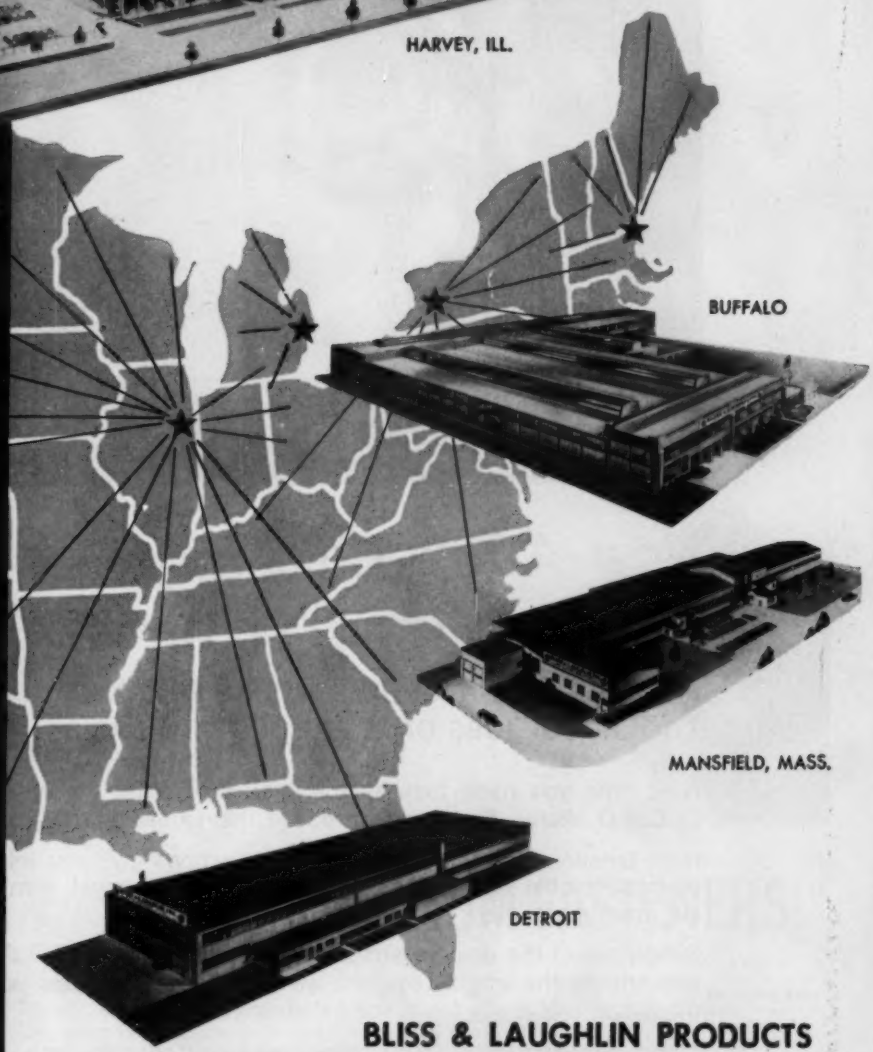


HARVEY, ILL.



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Cold Finished Steel Bars in Carbon, Alloy, Leaded Carbon and Leaded Alloy Grades

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SHAPES: Rounds, Hexagons, Squares, Flats, Extra Wide Flats, Special Sections

Specialists in Finish, Accuracy, Straightness, Strength and Machinability

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Now—A Low-Cost Way to Build Jigs & Fixtures!

PRE-MACHINED MICRON SECTIONS PUT YOUR TOOLROOM JOBS ON A PRODUCTION BASIS

Next time you need fixtures for short-run milling or drilling jobs, use Ex-Cell-O Micron Sections to produce them quickly and at low, low cost!

High tensile strength cast-iron Micron Sections give you inbuilt accuracy plus substantial savings in design and building time; you eliminate welding, cut machining time.

Simply select the desired shape and size from Ex-Cell-O Bulletin B-5914, and specify the length required; we'll deliver the sections you need—pre-machined and ready for minor detailing.

Micron Sections are available from stock by ordering through your local Representative or direct from Ex-Cell-O. Send for data sheet and price list today.

BRIEF SPECIFICATIONS

Cut to order from 25″ lengths. Wall thicknesses from ⅜″ to 1¼″. Width and height from 3″ x 3″ to 8″ x 8″. Machined square and parallel within .005″ per foot on all surfaces except ends and interiors of hollow shapes.

MMT PE

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Machinery Division

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • ATOMIC ENERGY EQUIPMENT • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

60-7

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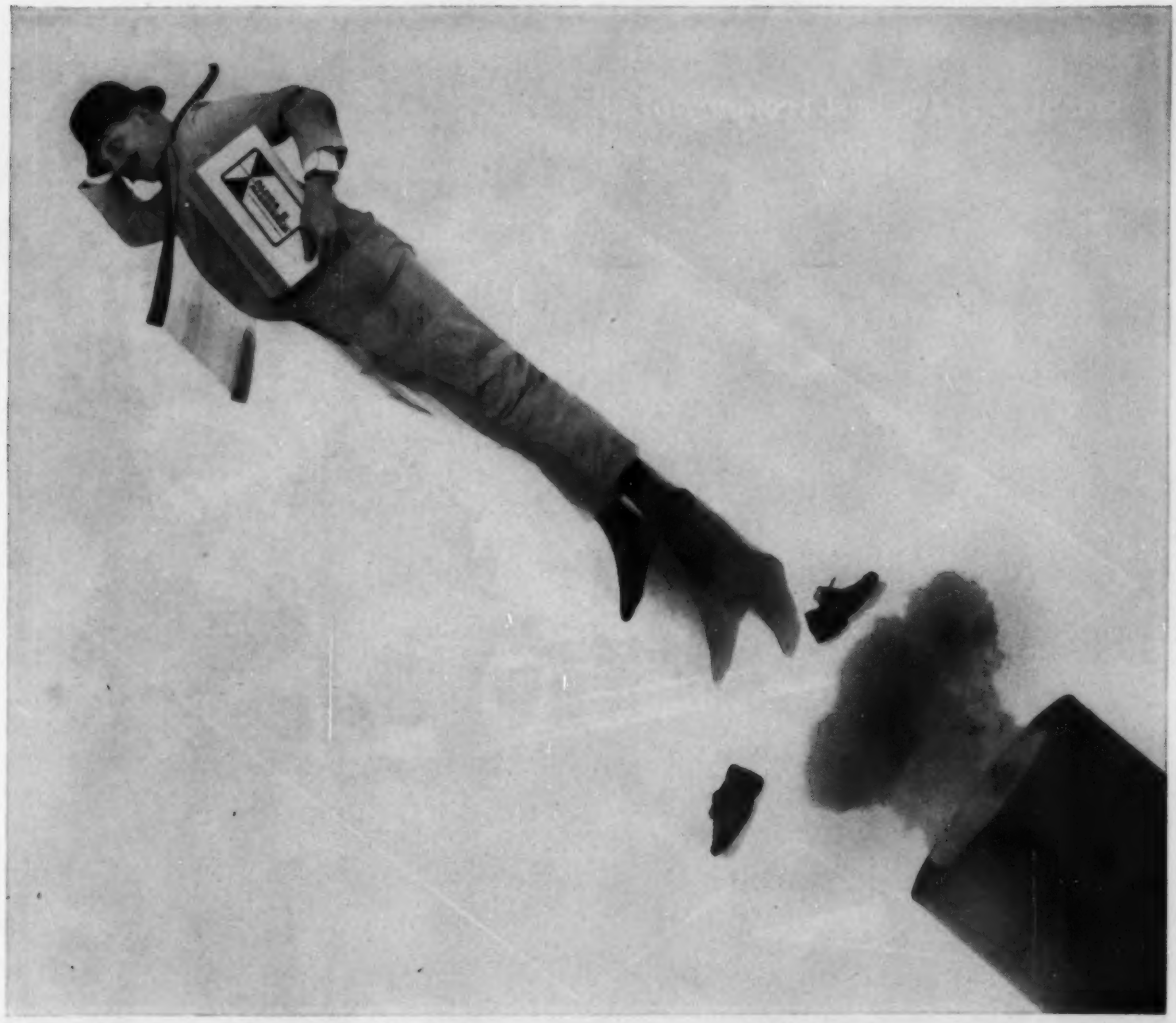
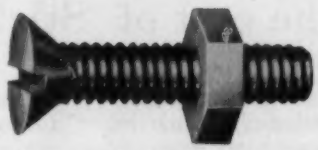


Faster than you can say "ALCOA ALUMINUM FASTENERS!"

Not *that* fast. But very fast—because there's a local distributor in your Yellow Pages, with full stocks of Alcoa® Aluminum Fasteners. It doesn't matter what you need . . . rivets, nuts, bolts, machine screws, wood screws, sheet metal screws, washers, anything in standard types and sizes. Just call your Alcoa distributor for quick service.

Not only quick service. This distributor offers a good many other advantages, too, when you order Alcoa Aluminum Fasteners from him. The largest line of aluminum fasteners. The highest quality . . . meaning full threads; no burrs; fully heat-treated, high-strength alloys; corrosion resistance. *And* full count—exactly what you order, no misfits, no rejects, no "seconds"—means lower production costs for you.

So . . . all in all, when you consider the time and money you'll save, and the beautiful appearance of your finished product, and the lasting satisfaction . . . you ought to call your Alcoa distributor now. (Want more data, and samples? Mail the coupon!)



For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV and "Alcoa Theatre" alternate Mondays, NBC-TV

Aluminum Company of America
2000 R Alcoa Building, Pittsburgh 19, Pa.

Please send me complete specification data and samples of Alcoa Aluminum Fasteners.

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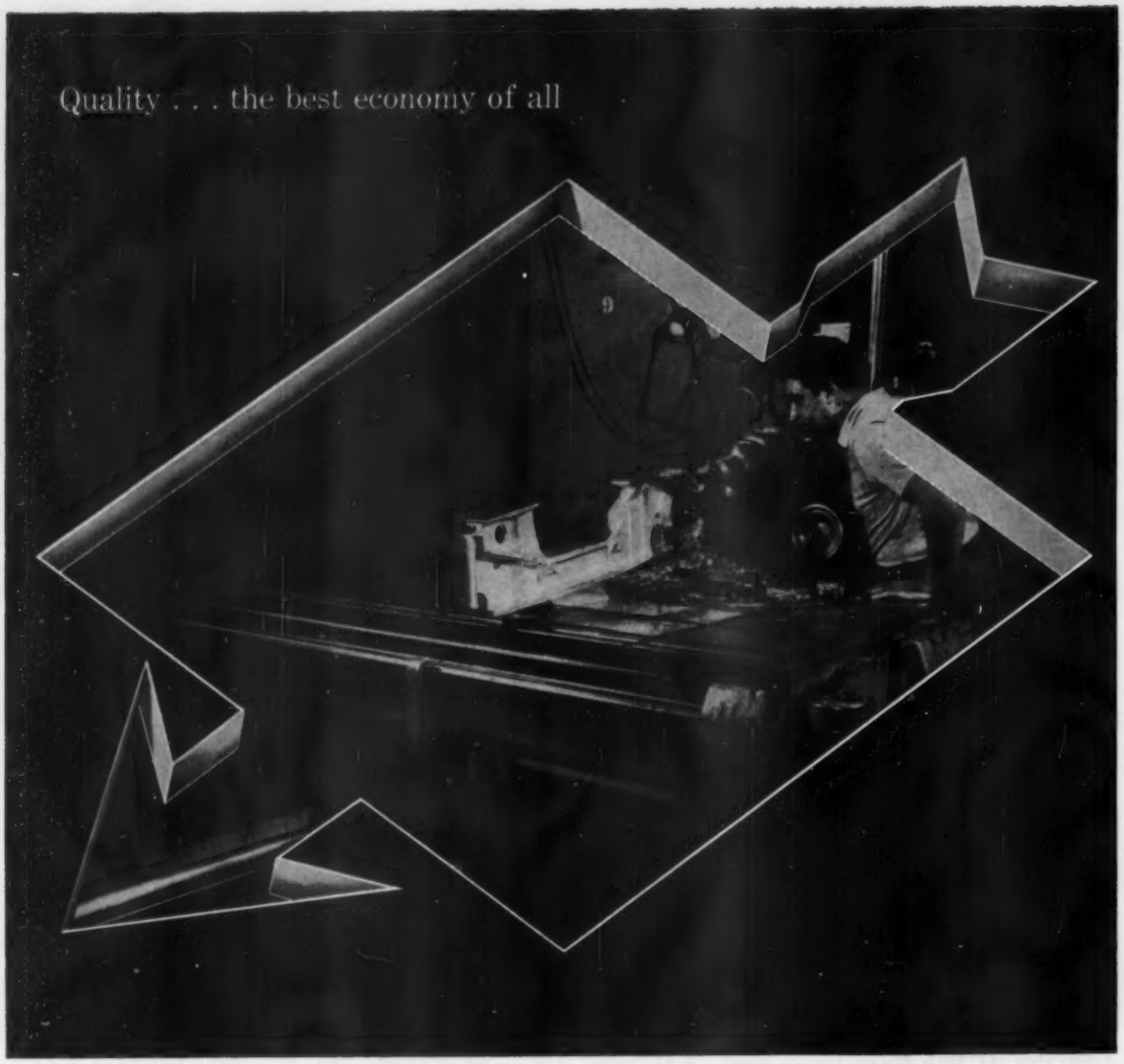
ALCOA ALUMINUM

ALWAYS FASTEN ALUMINUM WITH ALCOA ALUMINUM FASTENERS



Fight the cost of "Stick-Slip" with Sunoco Way lubricant

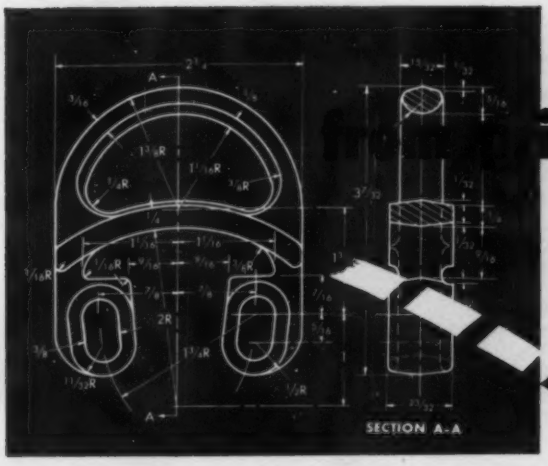
"Stick-slip", the alternate grabbing and releasing of slow-moving carriages, can seriously score machine ways and ruin fine workpiece finishes.

Avoid this trouble and expense with Sunoco Way Lubricant, known throughout the world for its ability to cure "stick-slip". Special ingredients in Sunoco Way Lubricant form a durable, reinforced lubricating film along the mating surfaces. Result: There is no metal-to-metal contact even during week-end shutdowns; machines start easily; carriages move without intermittent grabbing. YOU GET FINER FINISHES, FEWER REJECTS.

Ask your Sun representative to show you how others have benefited by using Sunoco Way Lubricant. Or write to Dept. AM-4. SUN OIL COMPANY, *Philadelphia 3, Pa.* In Canada: Sun Oil Company Limited, Toronto and Montreal.

SUNOCO

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES



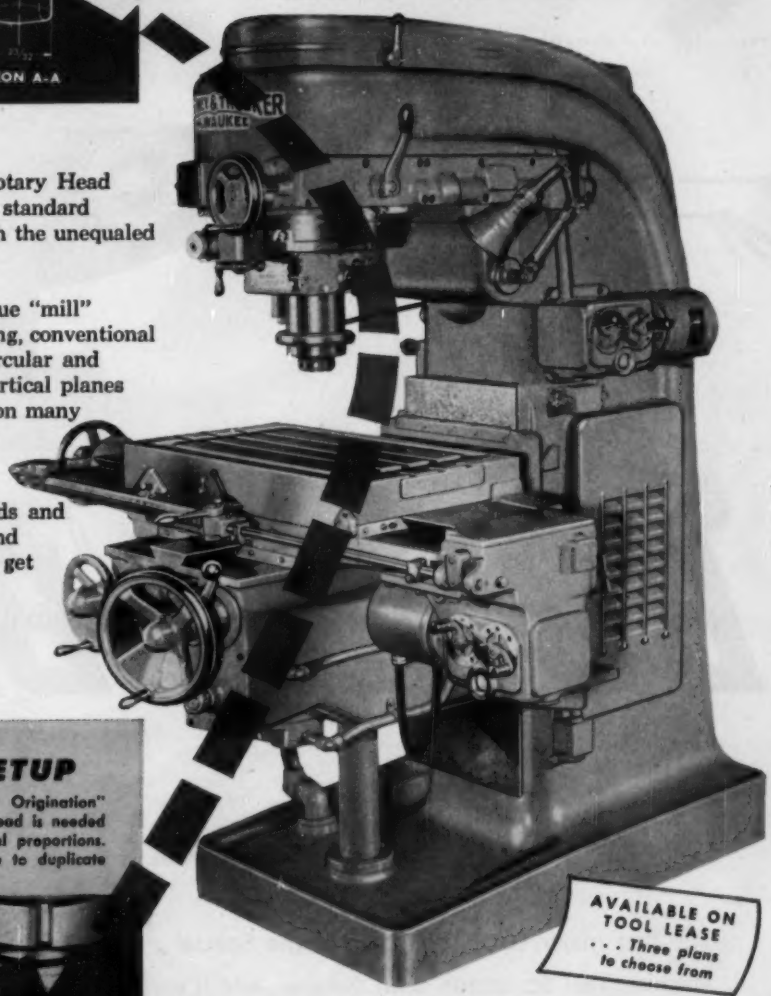
...int to finished product in a single setup

... WITHOUT TEMPLATES AND TRACING EQUIPMENT

The Kearney & Trecker Model D Rotary Head Milling Machine is the most *versatile* standard machine tool in existence today — with the unequaled bonus of *accuracy* to tenths.

The rotary head design of this unique "mill" permits precision boring, drilling, slotting, conventional vertical milling, and the milling of circular and angular cuts in both horizontal and vertical planes with the simplest of setups — in fact on many jobs, such as the one illustrated below, only a single setup is required.

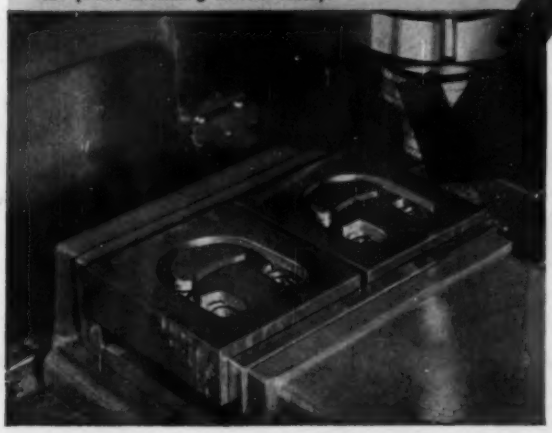
If you're machining tools, dies, molds and other parts requiring multiple radii and extremely close tolerances, be sure to get all the facts on the Model D Rotary Head Milling Machine.



AVAILABLE ON TOOL LEASE
... Three plans to choose from

BRASS DIE COMPLETED IN
ONLY ONE SETUP

A new machining principle called "Multiple Origination" provides that only one setting of the rotary head is needed to handle one or more operations of identical proportions. After the head is set, merely move the table to duplicate the preset machining motion exactly.



Call your local Kearney & Trecker representative or write today and ask for the Model D Literature File.

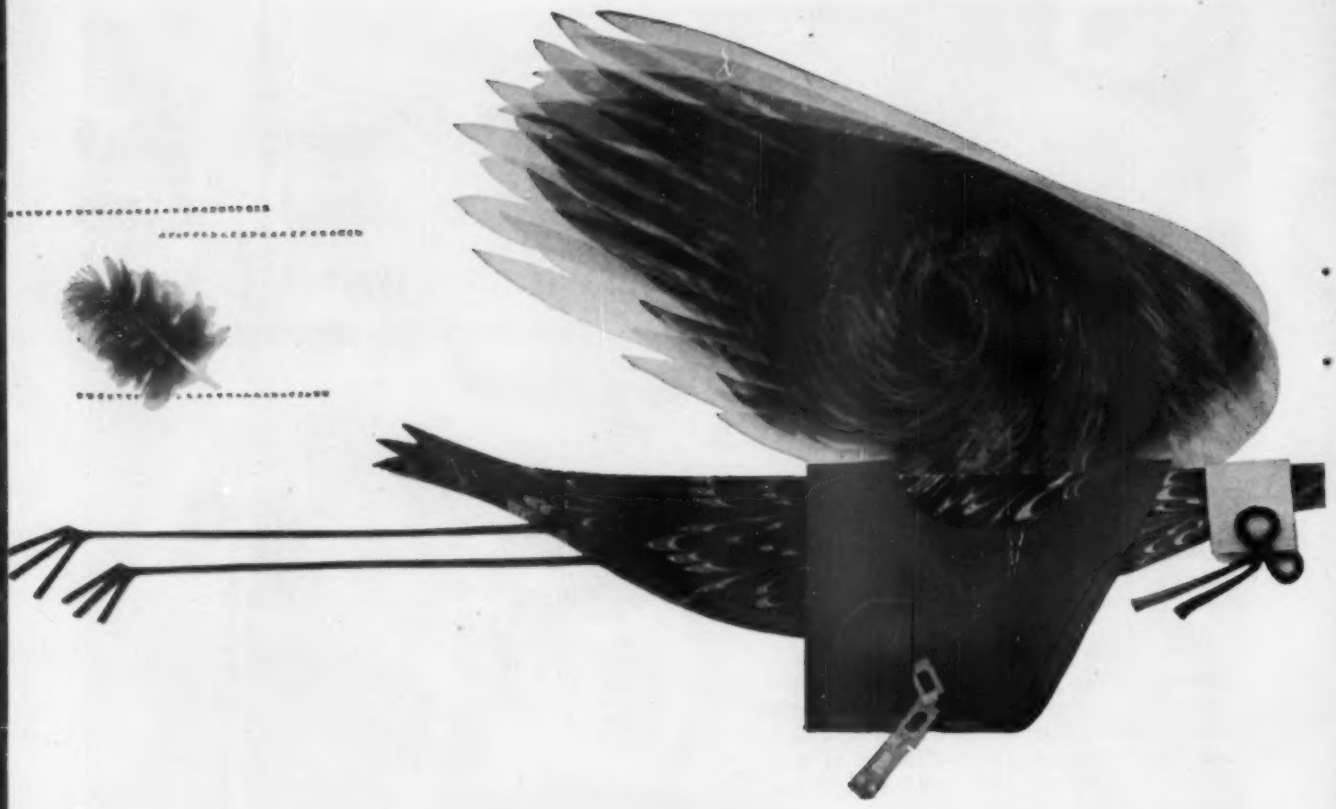
KEARNEY & TRECKER MILWAUKEE ®

Standard Machinery Division

KEARNEY & TRECKER CORP.

6800 W. NATIONAL AVE. • MILWAUKEE 14, WIS.

(Phone GReenfield 6-8300... Direct Distance Dialing Code 414)



BUHR'S "BABY"

The first major equipment built to the Special Machine Tool Standards is on the way. And it's Buhr's Baby! A lift-and-carry type transfer that will perform 323 precision operations, Buhr's Baby will be the most flexible and readily convertible multiple operation machine tool ever built. Manufacturing was started in December. Future ads will keep you posted on progress.

BUHR MACHINE TOOL COMPANY • ANN ARBOR

Report to the **SMTS** *Committee*

is
...on the
way!

MICHIGAN

BUHR
ECONOMATIC

How are they doing down on the farm?

Nowadays they're doing everything a lot easier, thanks to modern power-operated farm machinery.

And farm machinery producers have learned that their lot can be a lot easier, too, when they specify Ostuco Tubing. That's because there's no compromising with custom-quality Ostuco Tubing. Consistently you receive the exact tubing you want — the size, length, grade — with the strength and tolerances you need. For machined parts, you get our recommended rough size guaranteed to clean up.

In addition to these advantages, Ohio Seamless will fabricate tubular parts to your specification. Contact your nearest Ohio Seamless representative, or send part drawings to the plant at Shelby, Ohio—Birthplace of the Seamless Steel Tube Industry in America.

See us at Booth 629 Design Engineering Show May 23-26

A-1358A

Model illustrated built to 3.5 mm scale.

Complimentary Copy of new Bulletin CS60 "Ostuco Steel Tubing" sent on request.

OSTUCO SHELBY, OHIO

OHIO SEAMLESS TUBE

Division of Copperweld Steel Company • SHELBY, OHIO

Seamless and Electric Resistance Welded Steel Tubing • Fabricating and Forging

SALES OFFICES: Birmingham, Charlotte, Chicago (Oak Park), Cleveland, Dayton, Denver, Detroit (Huntington Woods), Houston, Los Angeles (Lynwood), Miami, Moline, New Orleans (Chalmette), New York, North Kansas City, Philadelphia (Wynnewood), Pittsburgh, Rochester, St. Louis, St. Paul, Salt Lake City, Seattle, Tulsa, Wichita

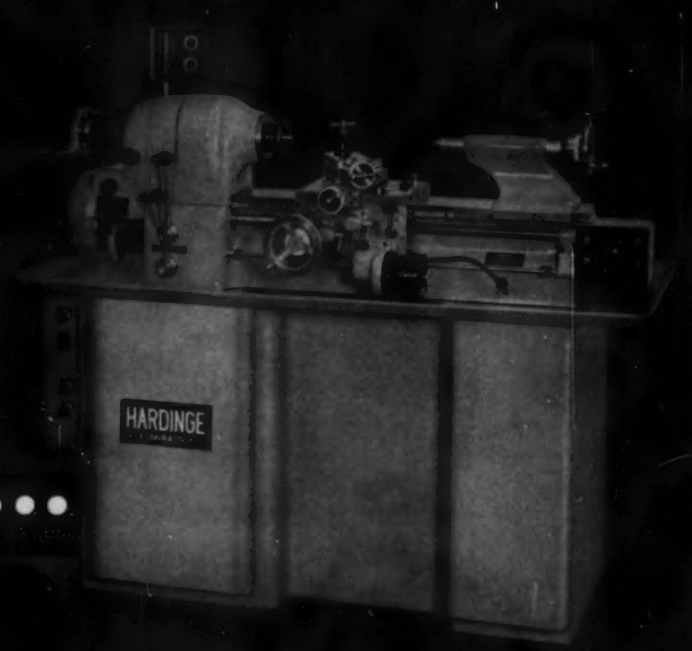
CANADA: Railway & Power Eqpt. Corp., Ltd. EXPORT: Copperweld Steel International Company, 225 Broadway, New York 7, New York

CIRCLE 219 READER SERVICE CARD

CIRCLE 220 READER SERVICE CARD ►

HARDINGE
ELMIRA, N.Y.

EASY READING HARDINGE BLACK AND WHITE DIALS



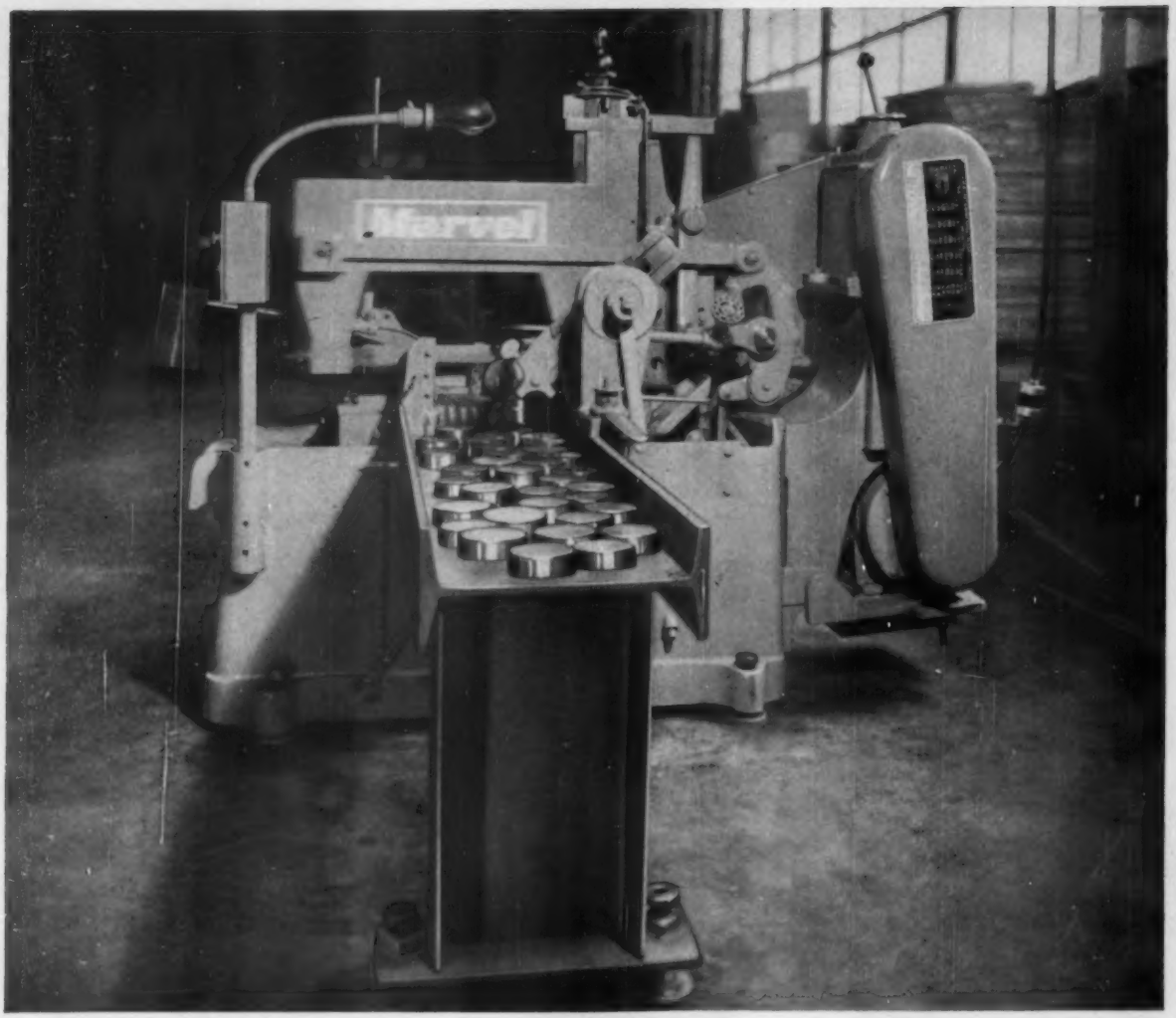
MEAN INCREASED PRODUCTION . . .

. . . **HARDINGE** developed these fast setting easy reading **black and white dials** — they assure maximum accuracy with high production.

Pioneered with the Hardinge High Speed Precision Tool Room Lathe model HLV shown here — **Hardinge black and white dials** are now standard equipment at **no extra cost** on all of our tool room and production machines.

Invest in Hardinge equipment for product improvement and increased production. Ask for bulletin on our tool room and production machines.

HARDINGE BROTHERS, INC.
ELMIRA, N. Y.



Payoff End of a Production Marvel

A cut-off saw's value is proven at the discharge end of the machine. How quickly the trough is filled with accurately cut-off pieces can mean the difference between profit and loss on many jobs.

The R. J. Sudrick Co., Des Plaines, Illinois, manufacturers of precision aircraft components had to cut-off 4600 blanks from 3¼" round, 303 Stainless Steel Bars.

They bought our MARVEL No. 6A4 High Speed Heavy Duty Automatic Bar Feed Hack Saw Machine; used MARVEL High-Speed-Edge Hack Saw Blades, and got the high production, accuracy and economy they desired.

PRODUCTION? Constant at 20 pieces per hour floor to floor

ACCURACY? Held well within the permissible tolerance of +.010 —.000

BLADE COST? Just 1½¢ per cut. Only twenty-three MARVEL blades were needed to make the 4600 cuts, and not a single blade failure due to blade breakage. MARVEL High-Speed-Edge Blades are unbreakable.

The point is this: MARVEL Metal Cutting Hack Saws equipped with MARVEL High-Speed-Edge Hack Saw Blades are an unbeatable combination for economical, accurate and safe cutting-off.

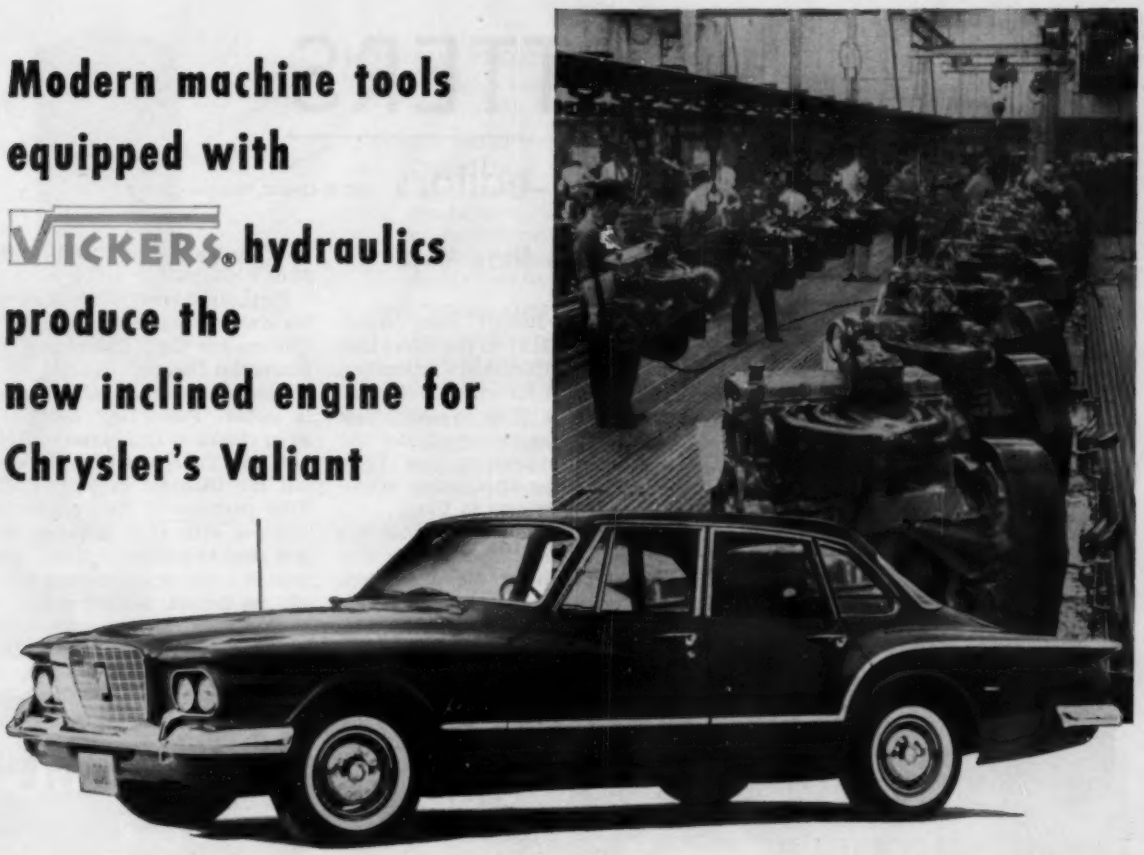
If your hack saws are not producing the economy you need to meet today's competition, try MARVEL High-Speed-Edge Blades. They will give you the competitive edge every time. Write for Catalog C-85 which has the complete story on MARVEL Hack Saws and Band Saws, Hack Saw Blades and Band Saw Blades.

ARMSTRONG-BLUM MFG. CO.

5700 W. BLOOMINGDALE AVE., CHICAGO 39, ILL.

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

Modern machine tools equipped with VICKERS® hydraulics produce the new inclined engine for Chrysler's Valiant



Machine tools of the most modern design are required to produce the new inclined six-cylinder engine for Chrysler's Valiant in volume and to the required precision standards. A walk through the Trenton, Michigan, engine plant quickly establishes the fact that the majority of hydraulically operated machine tools are equipped with Vickers hydraulics. (See tabulation at right.)

Machine builders and users have long been aware that performance goes up and maintenance decreases when Vickers hydraulics are specified. *One* reason is that each Vickers pump, motor, and control element represents advanced hydraulic design and manufacture. *Second*, unmatched application engineering experience is applied to planning the installation. *Finally*, service wherever necessary is promptly provided by technicians who are Vickers hydraulic specialists. More details are available about specific products and services in the *all new* Catalog 5001.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
DETROIT 32, MICHIGAN

8537

VISIT US IN BOOTH 1725 AT THE DESIGN ENGINEERING SHOW NEW YORK COLISEUM, MAY 23-26

These machine builders use Vickers hydraulics

Apex Corporation
Barnes Drill Co.
Bilt-Rite Tool Co.
Buhr Machine Tool Co.
Century Spray Corp.
Cleveland Hobbing Machine
Colonial Broach & Mach. Co.
The Cross Company
Ex-Cell-O Corp.
Fitchburg Engineering Corp.
The Foote-Burt Co.
Gisholt Machine Co.
Greenlee Bros. & Co.
Heald Machine Co.
Industrial Metal Products Corp.
The Ingersoll Milling Mach. Co.
F. Joseph Lamb Co.
Landis Tool Co.
The LaPointe Machine Tool Co.
LaSalle Machine Tool, Inc.
The R. K. LeBlond Mach. Tool Co.
Leland Detroit Mfg. Co.
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SPEED-BAND®

Capewell's new concept in band saw blades is setting new production records

ON ALL KINDS OF JOBS

ON ALL KINDS OF MATERIALS

ON ALL KINDS OF MACHINES

Ask your Capewell Distributor for the complete story.

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INDUSTRIAL DISTRIBUTORS THE RIGHT HAND OF PRODUCTION

CAPEWELL

THE CAPEWELL MFG. CO.
HARTFORD 2, CONN.

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Not a Mass Move

Dear Sirs:
Your "Field Report" item (*AM*—Jan 25 '60, p211) to the effect that the Thiokol Chemical Corporation would center its entire rocket activity in the Utah area has left many of your readers under the erroneous impression that Thiokol is moving all division activities and programs to Utah.

Let me hasten to say that this is not the case. The fact is that the corporation's many research and development and production programs will still be handled by the various divisions in their present locations.

However, Dr H W Ritchey, who is in charge of Rocket Operations and who was formerly located in Huntsville, will establish his headquarters in the Ogden, Utah, area. From there he and his staff will coordinate division activities.

Tom Johnston
for Thiokol Chemical Corp

-Tic—not-Tick

Dear Sirs:
We would like to bring up a couple of small points in connection with the letter from Mr Nilsson on "Hard-surfacing" (*AM/MM*—Mar 7 '60, p62).

First, Sintercast Corp of America was recently purchased by the Chromalloy Corp and is now the Sintercast Division.

Second, the machinable carbide is called "Ferro-Tic," not "tick" as in clocks or little insects. Actually, this Tic comes from the symbol for titanium carbide (TiC). Tiny particles of the carbide are sintered with alloy steel or stainless steel to achieve unusual hardness in a tool or component which can be drilled, milled, sawed, or shaped with conventional cutters.

Lucien Greif
Greif-Associates, Inc
New York, NY

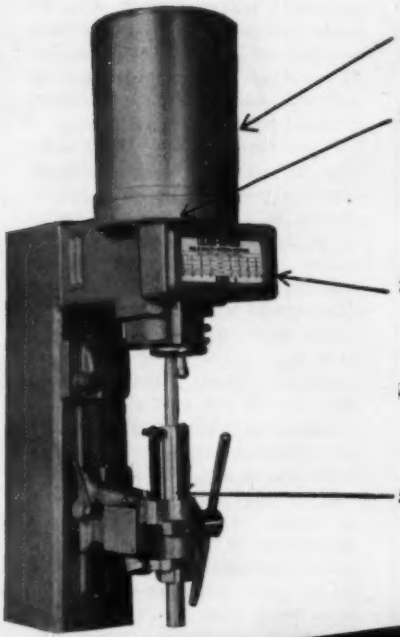
Things They Ought to Make

Dear Sirs:
My needs are those of a small shop operator—job shop—and I am my own janitor. Therefore, it is quite natural that I am interested in material that will help me develop techniques. Because I am somewhat isolated at my trade here in the Islands, *AM/MM* has helped me immeasurably.

There are several magazines written for the do-it-yourself home

SHOPMATES

N. Jarvis



1. TOTALLY ENCLOSED MOTOR

Windings and air gap completely protected from dust, dirt, chips.

2. DIRECT DRIVE

Direct drive from four-speed motor to spindle for smooth power transmission. For extreme speed range, can be furnished with back gears. Speeds from 90 RPM up to 3600 with torque multiplication up to six times supplies brute power for large drills, ample speed for drills down to 1/16".

3. INDICATING SHIFT

For positive speed indication. Tells right speed to use for drill sizes in three different SFM ranges. Convenient hand wheel shifts speed without stopping machine.

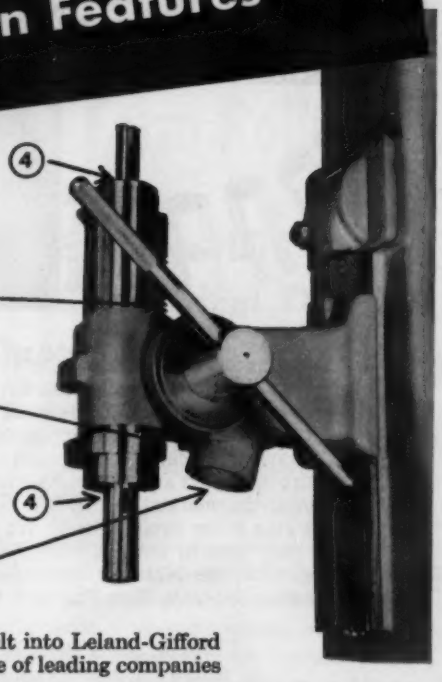
4. OIL MIST LUBRICATION

Radial-thrust ball bearings are constantly and properly lubricated at all speeds by oil mist. Spindle splines lubricated by felt wipers.

5. OVERSIZE SPINDLE QUILL

Oversize quills are 2 3/16" in diameter. Large bearing area maintains accuracy and assures long life.

Only LELAND-GIFFORD Drilling Machines have all these Precision Features



6. INSERTED STEEL RACK

Inserted steel rack prevents radial motion which can cause uneven tooth loads on feed pinion. Also insures accurate alignment when multiple heads are used.

7. BROACHED SLOT

Rack slides in slot precision broached into head.

8. SPINDLE GUARDS

Telescopic guard can be furnished to completely cover the spindle, protect operator from fast-moving multiple splines.

9. BUILT-IN LIGHT

Built into sliding head. Puts the light on the work where it ought to be. Never in the way like makeshift lighting.

Compare the quality, workmanship and precision features built into Leland-Gifford Drilling Machines and you will see why they are the first choice of leading companies for toolroom and production lines.

LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U. S. A.

Branch Offices:

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CLEVELAND 22
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DETROIT 21
10429 W. McNichols Rd.

INDIANAPOLIS 6
P. O. Box 1051

LOS ANGELES
2620 Leonis Blvd., Vernon 58, Cal.

NEW YORK
75 S. Orange Ave., South Orange, N. J.

ROCHESTER 12
P. O. Box 24, Charlotte Station

MARKS
AND GROOVES
at speeds up to
5,000 PIECES
per hour

DUAL OPERATION
saves time and money

Here is another example of the versatility, speed and economy of Noblewest modern metal marking equipment. Model 523 is shown tooled for simultaneous marking and grooving of tubular electrical connectors at production speeds up to 5000 pieces per hour. Gravity feed chute can be manually loaded or hopper fed making entire operation automatic. As with all Noblewest Roll Marking Machines, the marked inscription is permanently indented . . . lasts as long as the product itself. Whatever your marking problem, it will pay you to consult with Noblewest. For comprehensive catalog, write the Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.

Visit the Noblewest MARK-O-RAMA, Booth No. 1446, Tool Engineers' Show

MARK IT BEST WITH NOBLEWEST IMPROVED MARKING DEVICES
NOBLEWEST
ORIGINATORS OF THE ROLL MARKING PROCESS
MARKING
NUMBERING
EMBOSSING
GRADUATING

carpenter and craftsman. One of these publications has a section entitled, "I Would Like To See Them Make." I have often wished *AM/MM* had a page or section devoted to this type of inquiry.

For example, I would like to be able to purchase an inexpensive plastic socket which could be attached to a board or the inside of a drawer or shelving. The socket would provide efficient storage for taper-shank tools and fixtures and would offer protection to the taper portion at the same time.

Another item which I would also like to see available on the market would be a modification of the conventional, adjustable combination square. If there were a 90° groove on the square head, it would facilitate checking the squareness of round stock and cylindrical objects.

I am sure there are many of us who never have enough time to devote to developing ideas, and we have to wait patiently until mass telepathy causes it to be manufactured.

Griffith Woodruff
Woodruff Tool & Die Works
Honolulu, Hawaii

***At present we have no plans for the type of column suggested by Reader Woodruff, but we will be glad to consider similar ideas for publications in the "Letters" column*—Ed.**

Oversight

Credit for the Shop Shots item, "Heli-Arc Mechanized," (AM/MM—Feb 22 '60 p 108) was inadvertently omitted. The thermal switches are assembled at a turntable welding setup by Control Products, Inc, Harrison, N J.

"Now what do you think I'm waiting for? . . . Quitting time . . . of course!"

CALENDAR

American Society of Tool Engineers—Tool Show, Apr 21-28, Detroit Artillery Armory, Detroit, Mich.

Metal Powder Industries Federation — Annual Meeting and Powder Metallurgy Show, Apr 25-27, Drake Hotel, Chicago, Ill.

American Welding Society—Annual Convention and Welding Show, Apr 25-29, Great Western Exhibit Center and Biltmore Hotel, Los Angeles, Calif.

Instrument Society of America—Instrument-Automation Conference and Exhibit, May 9-12, Civic Auditorium and Brooks Hall, San Francisco, Calif.

American Society for Metals — Southwestern Metal Exposition and Congress, May 9-13, State Fair Park, Dallas, Texas.

American Foundrymen's Society—Castings Congress and Exposition, May 9-13, Convention Hall, Philadelphia, Penna.

Machinery Dealers National Association—Annual Convention, May 11-14, Edgewater Beach Hotel, Chicago, Ill.

American Institute of Industrial Engineers — National Conference and Convention, May 12-14, Sheraton-Dallas Hotel, Dallas, Texas.

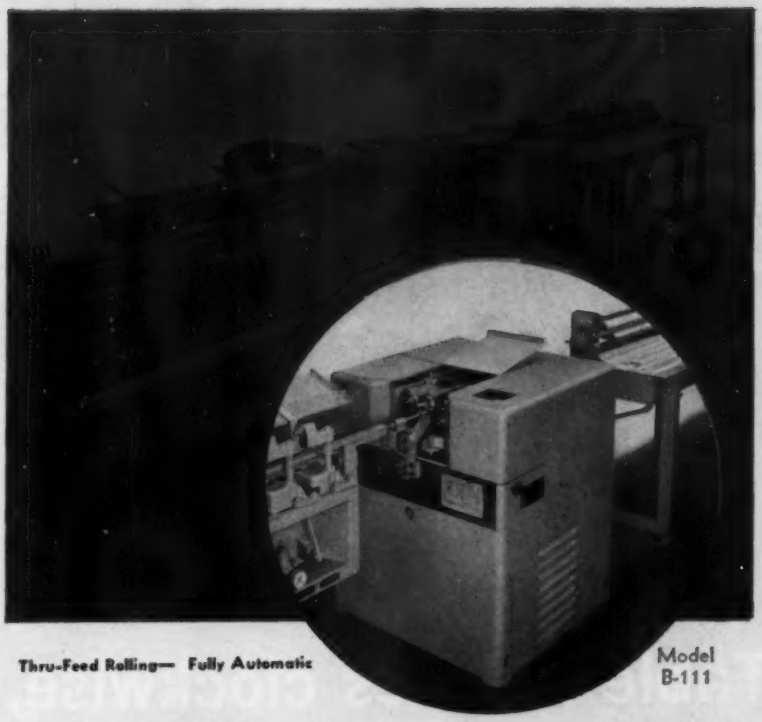
American Society of Mechanical Engineers — Production Engineering Conference, May 17-19, Hotel Schroeder, Milwaukee.

National Institute for Disaster Mobilization — Industrial Mutual Aid Conference, May 18-20, Netherland-Hilton Hotel, Cincinnati, Ohio.

Design Engineering Show, May 23-26, New York Coliseum, New York, NY.

American Supply & Machinery Manufacturers Association — Triple Industrial Supply Convention, May 23-25, Conrad Hilton Hotel, Chicago, Ill.

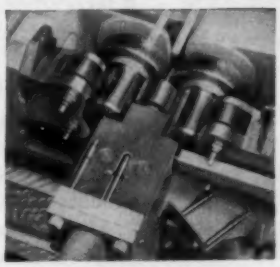
American Society of Mechanical Engineers — Summer Annual Meeting & Aviation Conference, June 5-9, Statler Hilton Hotel, Dallas, Texas.



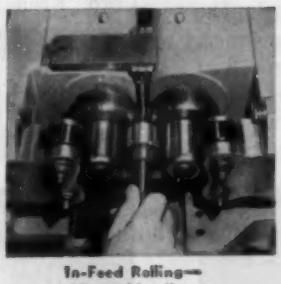
Thru-Feed Rolling— Fully Automatic

Model B-111

.... for Production or Job lot Threading and Form Rolling



In-Feed Rolling— Fully or Semi-Automatic



In-Feed Rolling— Manual loading

REED Two-Die Type Cylindrical Die Thread Rolling Machines

The flexibility of the Reed B-111 machine provides for the most economical selection of equipment to suit job lot or quantity production requirements.

Standard machines are available for in-feed or thru-feed rolling or a combination of both for a wide range of thread and form rolling applications. Precise micrometer die and work positioning adjustments assure continuous production of uniform accurate threads and forms.

Write for Machine Bulletin B-111-1

REED RTD TRM-173

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

HOLDEN, MASSACHUSETTS, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

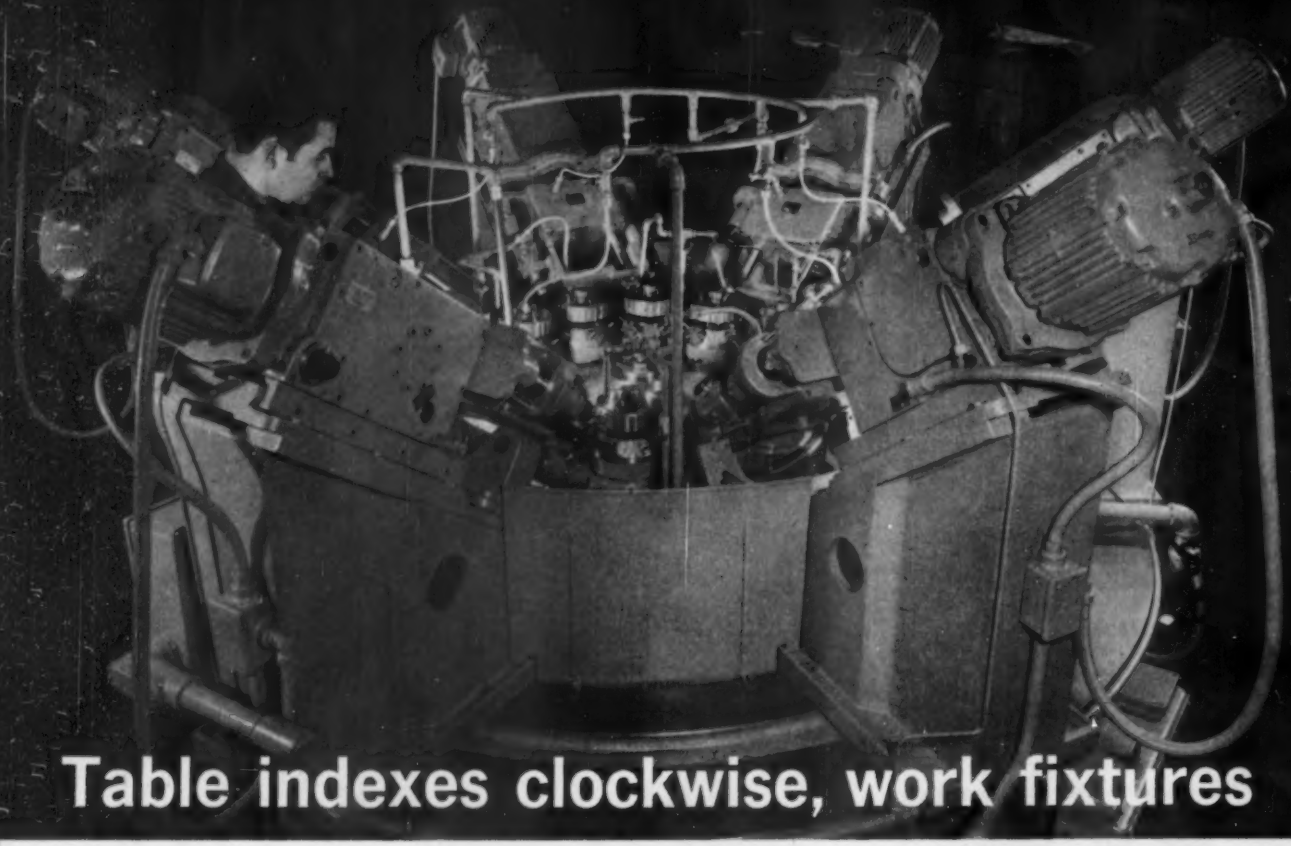


Table indexes clockwise, work fixtures counterclockwise for 6 holes 60° apart

Kingsbury machine drills and c'bores 135 steel forgings per hour gross

Problem: C'bore and drill six angular holes 60° apart in a forged steel gear.

Solution: Six drilling units with two-spindle heads are mounted on angular columns 60° apart on a circular base. An index table holds 12 work fixtures that do not turn with reference to any fixed point. As the table indexes clockwise 30°, each fixture indexes 30° counterclockwise. The work remains clamped as it indexes.

Each unit operates two tools downhill at a 27° angle. The first tool counterbores .1562 diam. at one station for an accurate start. The second drills .0397 diam. through at the next station. The operator changes parts in his fixture while the units perform their automatic cycles. Two tools operate at the same time on the part at the rear station.

Uniform Parts that Gage Maybe this seems simple. But it takes some doing to . . .

— build 12 fixtures that are exact duplicates, each one to hold the work firmly and accurately;

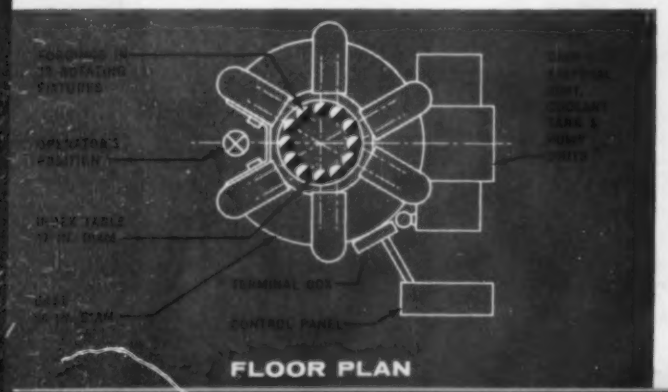
— remove backlash from the gears that index the fixtures;

— start angular holes straight and in exact position.

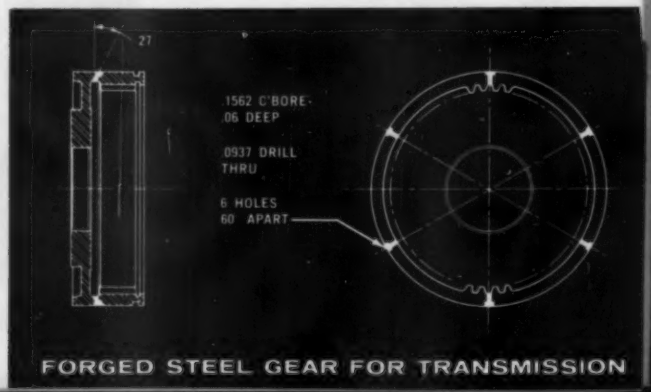
We specialize in solving such problems. Our machines have good basic design and accurate rugged construction to produce uniform parts that gage.

May we make you a proposal? You can then place one order for the entire machine and make us fully responsible that it meets your specifications. Kingsbury Machine Tool Corp., Keene, New Hampshire.

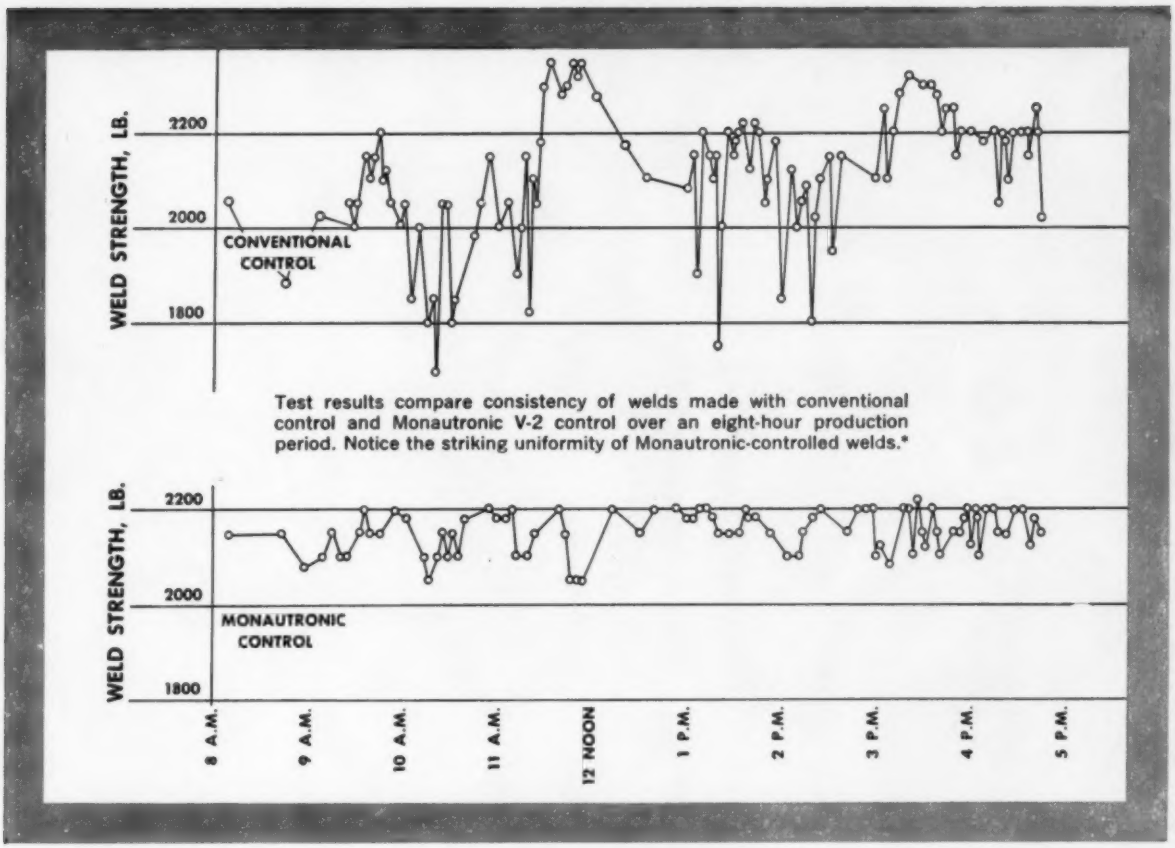
KINGSBURY MULTI-UNIT AUTOMATICS



FLOOR PLAN



FORGED STEEL GEAR FOR TRANSMISSION



Test results compare consistency of welds made with conventional control and Monautronic V-2 control over an eight-hour production period. Notice the striking uniformity of Monautronic-controlled welds.*

new feedback control gives you consistently high quality welds . . . automatically

Monautronic V-2 welding control has fully automatic sequencing with all provisions for single spot, roll spot and seam welding.

The new *Monautronic V-2* welding control makes use of the latest advances in electronic computing to overcome automatically such obstacles to weld quality as line voltage fluctuation, electrode wear, variations in electrode tip force, surface finish and shunting.

The control compensates for undesirable variations usually encountered in resistance welding by maintaining voltage across a weld at a constant value. This constraint of voltage amounts to constraint of final weld temperatures, and such temperature control assures uniform production of high quality welds.

Any metal that can be resistance welded can be welded better with the Monautronic V-2 than with any other control on the market.

For complete details, contact THE BUDD COMPANY, Electronic Controls Section, Philadelphia 32, Pa., or one of our regional offices.

*Case study upon request.

2450 Hunting Park Ave. Philadelphia 32, Pa. ■ 12141 Charlevoix Ave. Detroit 14, Mich. ■ 3050 East 11th St. Los Angeles 23, Cal.

ELECTRONIC Budd CONTROLS

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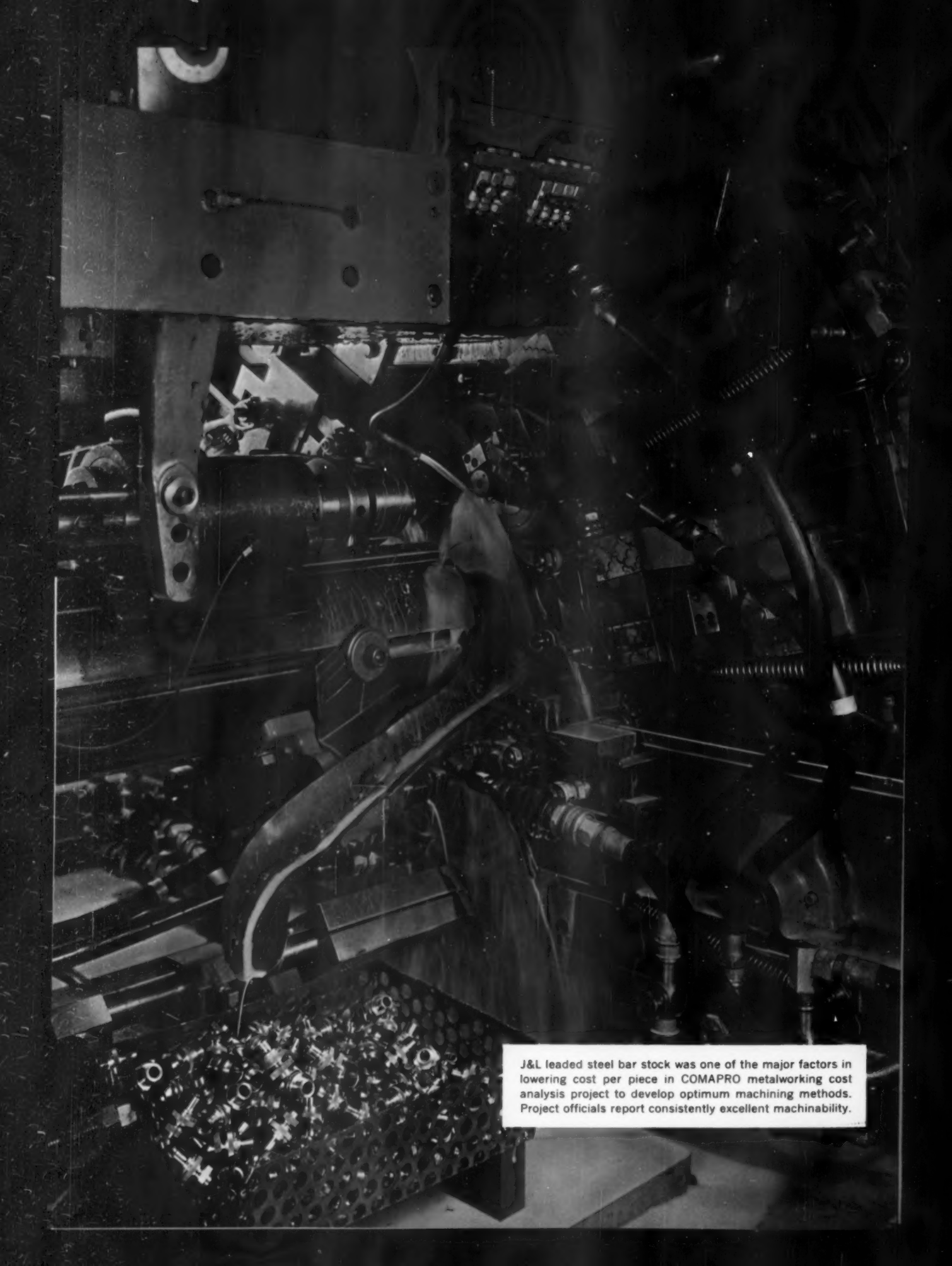


J&L leaded steel bar stock was one of the major factors in lowering cost per piece in COMAPRO metalworking cost analysis project to develop optimum machining methods. Project officials report consistently excellent machinability.

Final COMAPRO tests prove . . .

J&L leaded steel bars are a key factor in cutting production time 30%

Excellent machinability of J&L Type A leaded cold finished bars has been proved by the widely recognized cooperative machining program conducted at Cone Automatic Machine Company, Inc., Windsor, Vt.

COMAPRO's final report covered a period of many months of tests on the machining of spark plug shells under scientific laboratory-controlled conditions.

It highlights these important facts:

1. Production time per machined unit was cut from 6.5 to 4.41 seconds—a reduction of approximately 30%.
2. The tools of the automatic bar machine demand a degree of uniform machinability in the bar stock which J&L Type A leaded steel consistently provided.
3. The free machining quality of J&L leaded steel reduced tool changes.

These results are typical of the benefits many companies have been getting with J&L free-machining steels. In actual production runs, the use of J&L's Type A leaded steel has increased overall output rates 22%, reduced tool costs 50%, and has required less power than making similar parts of conventional steel.

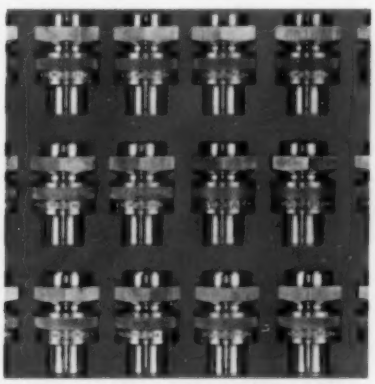
This Steelmark identifies products made of steel. Place this mark on your products. And look for it when you buy.

Steel

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

Where cold rolled steels originated in 1859



Spark plug shells were selected as typical machined parts for COMAPRO tests. Note superior finish of completed units produced from J&L 13/16" leaded hexagon bar stock.

COMAPRO tests were run on this six-spindle Cone automatic bar machine which permits continuous end-to-end feed of bars from the reel into the machine.

New two-unit feed mechanism developed by COMAPRO provides quieter operation, longer tool life, stock savings, closer tolerances and other important advantages.

J&L STEEL

Six machining steps are required to produce the spark plug shell. Machining cycle time was cut 30%, due in large part to the fine machinability of J&L's leaded steel.

COMAPRO emphasizes well organized tool control; makes use of modern pre-set, quick-change type of holders, with gauges. Result: time for tool changes is greatly reduced.

New Counting Flexibility

for Production, Materials Handling and Packaging

Veeder-Root Electro-magnetic Counters provide new and simplified methods for count-rolling all types of plant operations.

These counters are actuated electrically by a variety of methods as shown above, making them completely flexible in application. These methods include non-contact probes and photo-cells, miniature switches and built-in "make and break" or standard contact switches. In addition, these electro-magnetic counters can be easily remoted — at any distance — to office locations or for centralized production control.

Send for complete information on Veeder-Root Electric Counters . . . Take advantage of the many new opportunities for improved and simplified counter application, possible only with this Veeder-Root line.

Standard models available from your Veeder-Root Industrial Distributor; or write direct for help on specific problems.

A complete line of Electro-magnetic Counters

Series 1591 — Quick reset, high speed counter. Speed: 3000 cpm. Extra long life. 4 or 6 figures.

Series 1205 — Reset magnetic counter for base mounting. Speed: 1000 cpm. 6 figures.

Series 1507 — Small Reset Counter for base or panel mounting. Speed 700 cpm. 3 or 4 figures.

Veeder-Root

HARTFORD 2, CONNECTICUT

"The Name that Counts"

New York • Chicago • Los Angeles
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VRD-95

◀ CIRCLE 230 READER SERVICE CARD

▲ CIRCLE 231 READER SERVICE CARD

SPOT NEWS...

- **Giddings & Lewis Machine Tool Co** plans to move manufacture of its Giddings & Lewis/Bickford radial and upright drilling machines from its Cincinnati plant to its recently enlarged plants in Fond du Lac and Kaukauna, Wis. The Cincinnati plant has been sold to Cincinnati Milling Machine Co, but machinery there will be transferred to the Wisconsin plants. This action continues G&L's aggressive development and marketing of drilling machines to meet changing conditions in domestic and international markets.

- **Training for automation** will get a boost if Baltimore's Dept of Education gets requested Federal funds to expand its present program. About 200 students are enrolled, but this is expected to double as emphasis will now be on advanced work in tool design, metallurgy, hydraulics, and pneumatics. Program is designed to train technicians for new fields involving automation.

- **Central hydraulic systems for automobiles,** consisting of a pump and an accumulator which operates a number of accessories, are known to be in an advanced development stage at both Ford and Autolite. SAE has recently proposed tentative specifications for both petroleum-based and synthetic fluids.

- **Timken Roller Bearing Co** is considering putting up a plant in India to manufacture roller and ball bearings. If project goes through, it will involve a $6-million investment by Timken, and probably be undertaken in partnership with an Indian collaborator. SKF is already operating in India.

- **Improved ductility in tungsten rods** produced by arc-melting and extrusion indicates that this intractible metal may soon bow to metallurgical know-how. NASA's Lewis Research Center reports that initial fracture tests show a ductile, rather than a brittle-type, fracture.

- **The Soviets are using an electron-beam welder** to join such metals as titanium, tungsten, and molybdenum. There is no indication as to whether widespread use of the welder is planned. From the description given, the Soviet unit appears to be comparable to US electron-beam welders.

- **High-voltage forming** through underwater discharge of a high-voltage spark is being used at Convair-Fort Worth to form small airframe parts. Fully closed dies make full use of the high pressures generated. Small, portable unit is safe enough for in-plant operation by non-technical personnel. See page 104.

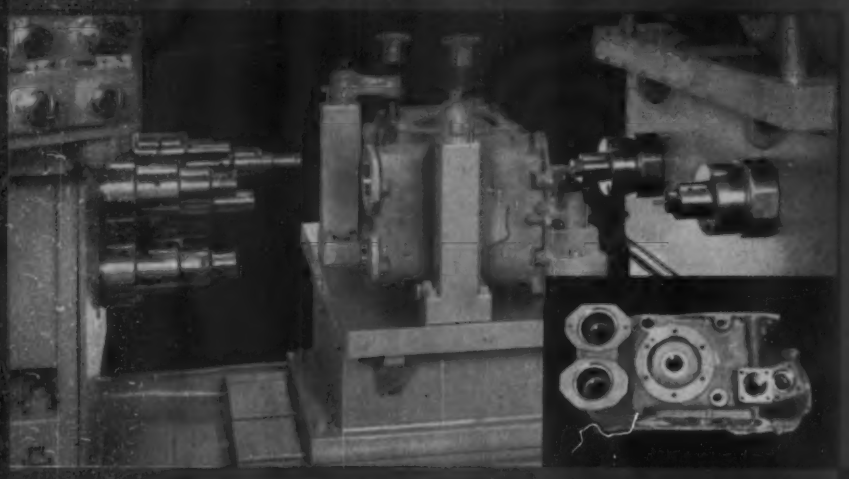
- **Additions of rare-earth element yttrium** help refine the grain structure of chromium, titanium, and zirconium, and may have a similar effect on copper and iron, according to two Soviet metallurgists. It also has a deoxidizing effect, they say, and it hardens aluminum and magnesium.

- **A 300% to 500% increase in the amount of plastics** used in cars within ten years, is the forecast of a high-ranking materials engineer at Ford Motor Co. Other reports say that this may be too conservative. Many suppliers are counting on at least a 600% rise in the next decade.

- **A heat-resistant coating** formulated for missile and space applications has withstood temperatures of 5000 F for periods up to 90 seconds. Designated D-65, it was developed by the Plas-Kem Division of Dyna-Therm Chemical Corp, Burbank, Calif, and is now being tested by RCA, Martin, Space Technology Laboratories, Douglas, Lockheed, and the USAF. Applications include protection of launching pad equipment, coatings for re-entry bodies.

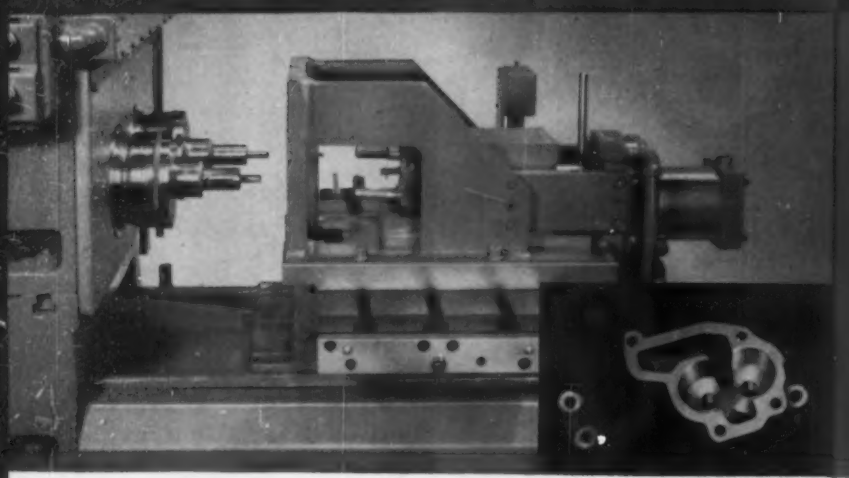
- **World outlays for steel industry expansion** and modernization will total $4.5-$5 billion in 1960. Approximately $1.6 billion of this total is scheduled to be spent by companies in the United States.

Standard Ex-Cell-O Precision Boring Machines



. . . FOR FASTER MULTIPLE-HOLE WORK

Standard style 17-A performs 26 operations in one cycle on a magnesium aircraft casting. Machine bores five bronze bushings, counterbores seven diameters, faces four surfaces and chamfers eight shoulders with five spindles at left, two spindles at right.



. . . FOR FASTER CLOSE-TOLERANCE WORK

Style 112-U finish-bores gear pockets and shaft holes, and plunge-faces pocket bottoms of oil pump bodies to tolerance of plus or minus .0005". Flat faces are square to the bores and parallel to each other within working limits of .001".

59-17

10 REASONS WHY EX-CELL-O PRECISION BORING MACHINES DO MORE, AT LESS COST!

1. **RUGGED**—Heavily-ribbed base castings, chatter-free hydraulic-actuated table movement, isolated power assembly.

2. **FLEXIBLE**—Bridges easily spaced-out for large work, moved in for smaller parts.

3. **VERSATILE**—Inbuilt versatility, plus Universal Fixtures for toolroom work, short-run and production jobs. Spindles mount in any position.

4. **FAST**—Rapid table traverse, positive spindle brakes and quick-load fixtures for high output.

5. **LOW TOOLING COST**—Standard machine components, tools and accessories cut lead time, speed setup.

6. **AUTOMATIC LUBRICATION**—Separate lubricating system pumps oil directly to the ways.

7. **SEALED SPINDLES**—Ex-Cell-O Precision Spindles permanently lubricated during assembly.

8. **CONVENIENT CONTROLS**—Easy to use hydraulic controls contained in a single panel.

9. **TROUBLE-FREE**—Vital machine parts and controls protected from dirt, chips, coolant. Ready access to components for inspection.

10. **CAMS FOR CONTOURING**—Cam-operated boring machines available for precision contouring work.

Call your local Ex-Cell-O Representative, or write direct for complete details on the full line of Ex-Cell-O Precision Boring Machines.

EX-CELL-O FOR PRECISION XLO

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

MMT-PE Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

CIRCLE 232 READER SERVICE CARD

WASHINGTON...

Pentagon budget reshuffling . . .

The administration has approved a massive reshuffling of defense spending plans over the next 18 months. It involves cutbacks totaling some $500 million for two key Air Force projects—production of the Bomarc B anti-aircraft missile (Boeing-Westinghouse) and construction of SAGE electronic air defense control centers (IBM and others)—and expenditure of this sum to step up procurement of Atlas ICBMs (Convair) and other USAF equipment.

A step-up in the Navy's Polaris missile-submarine program is also authorized—with most if not all the money to come from cutbacks in other Navy projects.

The change reflects the Pentagon's latest strategic thinking: (1) Downgrading costly anti-aircraft defenses planned for the long term; (2) shoring up the less expensive air defense systems for development just in the two or so years ahead (after which most US strategists believe there will little if any danger of an enemy bomber attack); (3) bolstering ballistic missile warning systems; and (4) expanding the size of the missile retaliatory force.

Atlas and Polaris speed-up . . .

The Air Force will order 18 more Atlas missiles (Convair)—an increase of roughly 15% in the force scheduled for development over the next three years. The missiles will be set up at bases already under construction or authorized.

The Navy will be allowed to buy long-lead time reactors for an unspecified number of additional Polaris submarines. Nine submarines are now being built, three vessels are authorized in the budget for next year, and procurement of reactors for three more subs are planned.

In recent weeks, the Navy also announced a $52-million acceleration in the present program to push six submarines into operation earlier than originally scheduled.

Other projects to be rushed . . .

Well over $100 million will be earmarked for modernization of F-101-B (McDonnell) F-102 (Convair) and F-106 (Convair) fighter aircraft. The planes will be armed with improved intercept radar, electronic data link equipment, and automated air-to-air rockets.

Orders for improved surveillance radars to "plug the gaps" in aircraft warning lines in Canada will be increased by about $15 million. Procurement of ballistic missile early warning radars will be boosted $42.5 million—to a new total of $406.9 million worth of production contracts in fiscal years 1960 and 1961.

The Minuteman ICBM development project (Boeing and others) now budgeted for $476.1 million next year, will be allotted an extra $27 million under the new USAF budget overhaul. Some of the additional funds will be spent for expansion of missile production facilities.

Over $50 million will be tacked on to budgets to speed development of the Midas infra-red warning (Lockheed) and the Samos reconnaisance satellites (Lockheed).

An extra $15 million will be awarded to Hughes Aircraft to push development of an extremely long-range airborne radar and air-to-air missile. This system was originally designed for the F-108, cancelled last year. Now it will presumably be used to strengthen performance of the operational F-106 fighter.

Automakers gripe over foreign bars

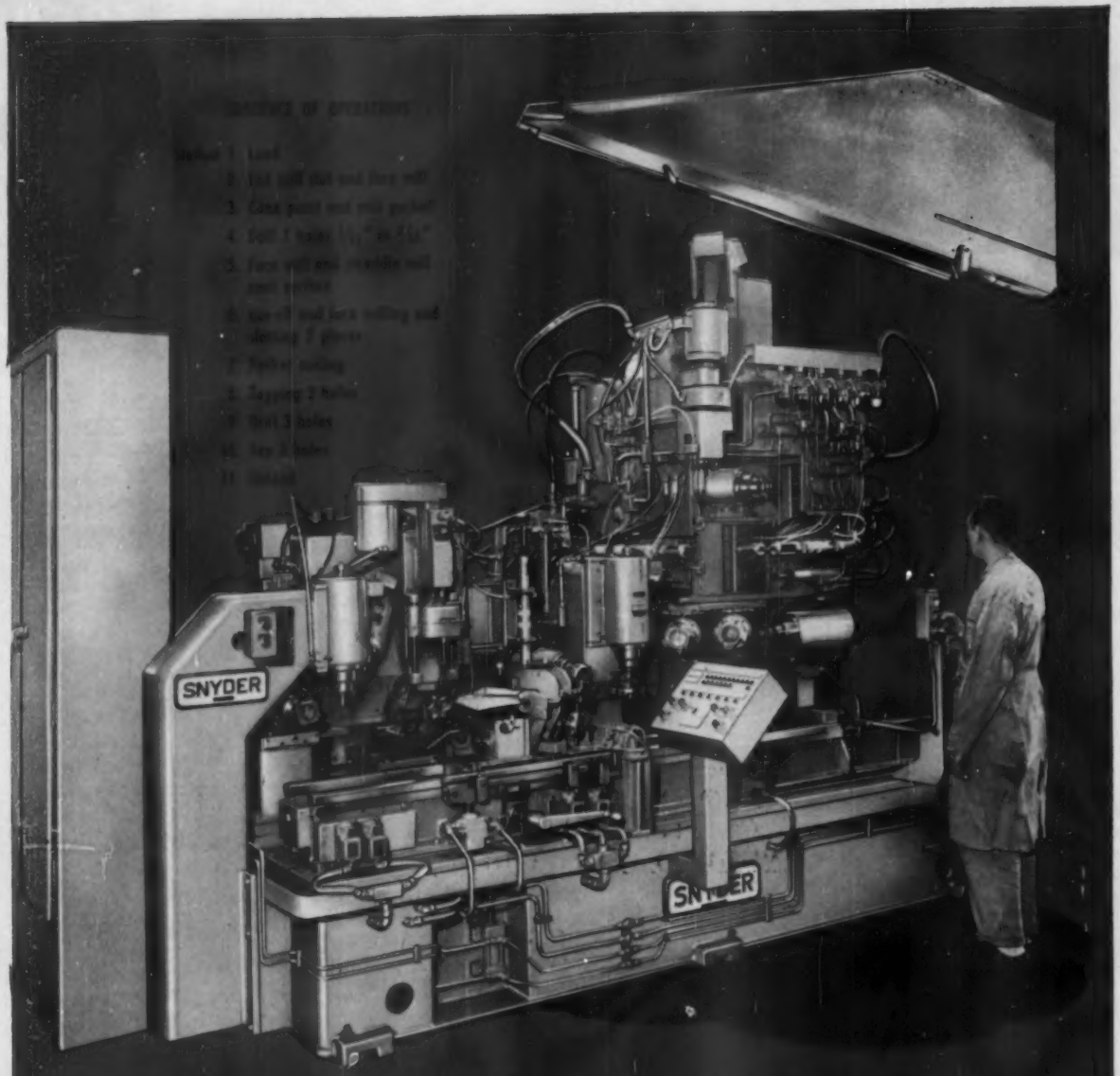
Detroit tells Washington it expects more restrictions against US auto exports from proposed new European Common Market and European Free Trade Association tariff schedules than under the old European dollar import quota discriminations.

The automakers reported their views to the Commerce Dept at one of a series of industry-government conferences called to spur new exports by domestic producers of all types of goods. It was the auto industry's first public reaction to the changed world market for autos brought about by the advent of European small cars and the two trade blocs.

The automakers proposed that Washington persuade European trade blocs to reduce their vehicle tariffs to a level "at least" as low as the internal rates proposed for trade between the members of each group.

But Government officials say such a unilateral reduction of European external tariffs is a virtual impossibility without some reciprocal concession by US negotiators at the tariff-setting sessions under the general agreement on tariffs and trade (GATT) at Geneva in the fall.

Trade experts here doubt the US could match such a concession even it were offered. But they are watching Detroit to see whether this proposal is intended as a maneuver toward a stand for higher US tariffs on foreign automobile imports.



COMPLEX MISSILE WING GETS 24 PRECISION OPERATIONS IN SPECIAL SNYDER PROGRAMMING TOOL

at Martin Company's Baltimore Division

Production rate, tolerances and part configuration dictated the fundamental design concept of this exceptionally compact tool which has 11 stations and performs 24 operations.

The cycle can be automatic, semi-automatic or manual. Controls for multiple cycle operations are provided by utilizing basic circuits triggered by a programming control device.

SNYDER CORPORATION

(Formerly Snyder Tool & Engineering Company)

3400 E. LAFAYETTE—DETROIT 7, MICHIGAN

Phone: LO 7-0100

DETROIT...

Spring surge here . . .

Though thermometers across most of the nation are scarcely aware of it, spring is here in the auto business. A total of about 575,000 new cars were sold in March for the best tally since the same month in 1955. However, second-quarter car output has been slashed significantly to about 1,750,000 cars.

Chevrolet, American Motors and Cadillac posted an all-time record first quarter. Chevrolet's March sales of 172,000 units were up 30% over last year, but of course this figure includes Corvair totals. AMC's March count of 37,205 was the third highest of any month in history, and Cadillac sold 41,105 units during the quarter. Dodge, thanks to its popular Dart model, was up a whopping 196% from a year ago.

Ford Division's first quarter total production was at an all-time high of 458,988 cars and 103,736 trucks. The Division's Director for Marketing Research, Robert J Eggert, recently said that retail sales of all makes help support forecasts of a 6,700,000-unit passenger car year. His research also indicates that there will be 850,000 new two-car families in 1960, for a total of 15% of all households. Eggert warned, however, of rising levels of used car stocks and unseasonably low prices.

More aluminum engines . . .

American Motors will startle those who think that radical engineering developments are mostly the province of the Big Three, by introducing with its 1961 models an all-new, in-line six-cylinder engine with block and head of die-cast aluminum. Doehler-Jarvis in Toledo will do the foundry work, with machining and assembly to be accomplished at AMC's plants in Kenosha. Six-cylinder engines account for the bulk of the company's output.

Chrysler Corp too will switch to aluminum for its present in-line six-cylinder engine used in Valiants, Plymouths, Darts and the forthcoming Dodge compact car. Raw pig will be shipped in from its Chrysalum affiliate in Canada, and die casting will be done at the Kokomo foundry. First use will be in 1961 models.

Olley and the future . . .

There is nothing quite so stimulating and rewarding for an automotive columnist as a chance to chat for an uninterrupted hour with Maurice Olley. Mr Olley, it will be remembered, has spent over 50 years in the industry here and abroad, contributing solidly to the engineering of cars ranging from Rolls-Royce to the Chevrolet Corvair.

He is the pioneer who preached that good handling and anvil-like springs do not necessarily go together. This thinking, daring for the period, led to his design for the type of front suspension that is in almost universal use today. As usual, his thoughts were 10 years ahead of the times when he dropped in to see us at our Detroit offices the other day.

"I remember back when Fred Lanchester was the only man who believed you could put a fire in a combustion chamber," he began. "But the mechanics of the time got cars to run pretty well, and the engineers took over. They reached a peak with what we call today a classic car, such as the 1931 Packard twin-six. It had a long hood and plenty underneath it, but accomodations were coincidental at the back end. Some had as many as 68 lube points, and the instruction manual was the size of the New Testament. Engineers fell from grace when they kept the long hood and put nothing underneath.

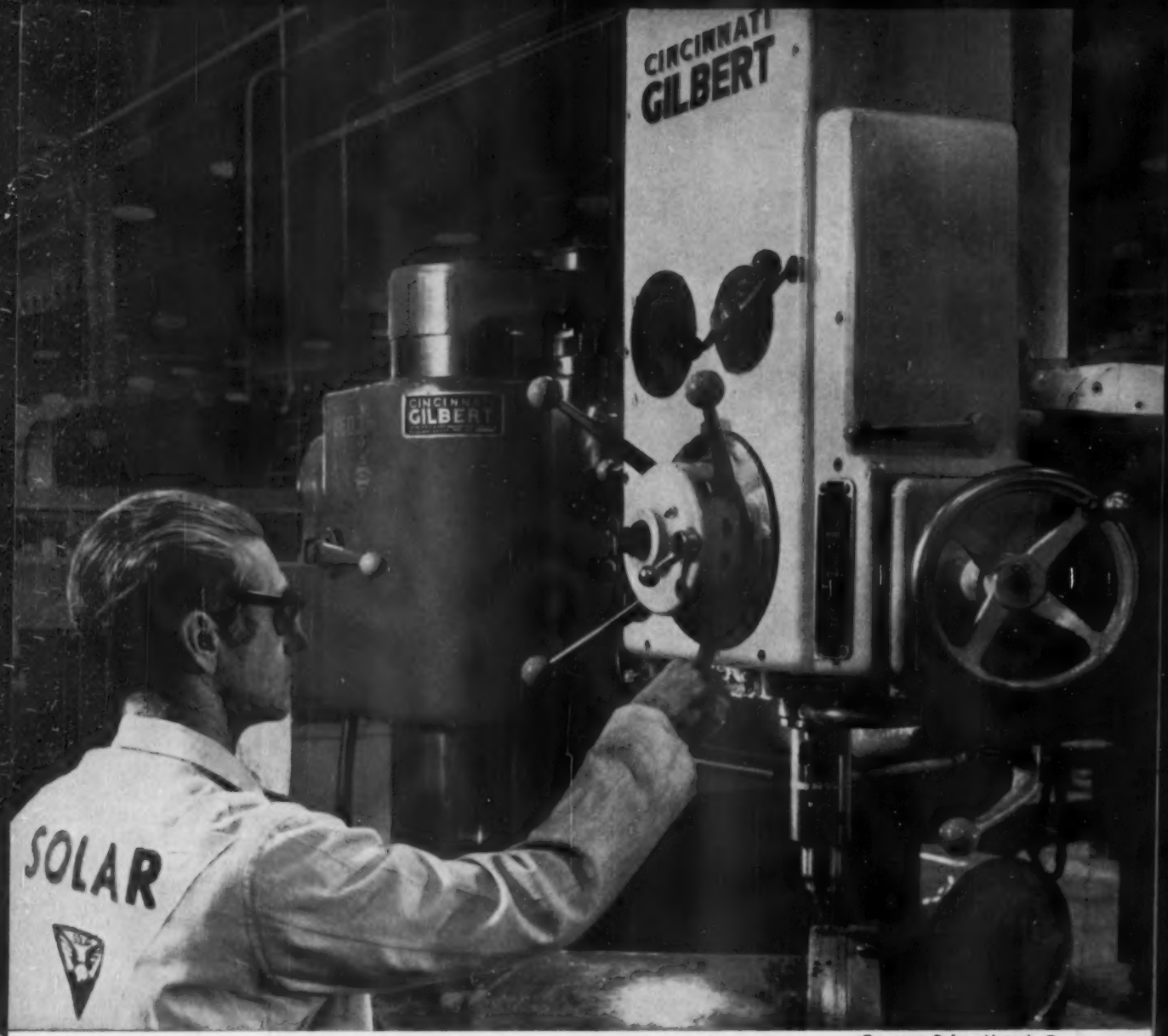
"We've always carried solutions to the verge of absurdity within any 25-year period. Then the stylists came along, preaching common sense. But what happened? They began bending sheet-metal for its own sake and costs climbed out of sight. They are about through now. From now on the public has the say, as witnessed by your new compact cars.

"This is the start of a new era. The engineers are going to get in again, full of ideas. The public is looking for variety so it will be excessively difficult to guess right."

We asked Mr Olley what was ahead in engines.

"The Wankel or the Stirling," he snapped without hesitation. "Turbines are too extravagant. The high compression Otto engine using high-test gasoline is just about dead. Has anyone really ever gotten more miles per dollar from these? If this were 1900, some enterprising mechanic would stick a Stirling engine in a vehicle. That's the attitude we want."

Mr Olley went on to explain that the Stirling cycle was originally developed as a substitute for the steam engine, to eliminate boiler explosions. It makes no noise, and does not have "halitosis of the exhaust pipe" because it burns enough excess air to insure complete combustion. The Dutch Underground, he noted, used it to power clandestine radio sets during World War II. The Wankel design, of course, is a rotary engine such as is now under development by NSU Werke and Curtiss-Wright. With it one could change the complete shape of a car.



Courtesy Solar Aircraft Company

Solar Aircraft uses Gilbert radials to produce close-tolerance holes

This operator at Solar Aircraft Company, San Diego, Calif., is drilling and tapping 57 holes to .001" tolerances in an afterburner housing for the J65 turbojet engine.

Several features make his work productive and accurate. Speed and feed shifters are direct-reading. Gears are counter-balanced for easy shifting. Four-lever turnstile is always within easy reach. The operator can see the spindle easily, as shown here.

This Gilbert radial is one of four at Solar—proof that you're in solid company when you acquire one of these fine machines.

Our representative will gladly give you the profitable details. Get a quotation now.

The Cincinnati Gilbert Machine Tool Co., 3340 Beekman St., Cincinnati 23, Ohio.

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GILBERT

AIRCRAFT and MISSILES... TRENDS

More Air Force cutbacks...

Two key Air Force projects—production of the Bomarc B anti-aircraft missile and construction of SAGE electronic air defense control centers—have been cutback some $500 million. The money will go into increased procurement of Atlas ICBMs and other USAF equipment. See page 85 for complete details on this reshuffling.

Budget troubles for Corvus...

The Navy's Corvus missile development project is up against a serious budget problem. Corvus is a radar-busting missile—an air-to-surface weapon which homes in on the beams of an enemy radar installation.

Navy wanted to speed up development work in fiscal 1961, beginning next July, so that production might get under way in the near future. Dr. Herbert York, the Pentagon's director of research and engineering, backs the Navy's request.

But the Defense Comptroller's office opposed the speedup proposal. Indeed, it recommended the project's termination, on grounds that are not very clear at the moment.

Defense Secretary Gates has ruled that the Navy can continue work on Corvus only by diverting funds from other R&D projects. The fiscal 1961 budget, still under study by Congress, does not set aside any new funds for Corvus. The Navy is now trying to earmark other funds for its radar-buster.

The Air Force has been under a similar bind this year on the Mace tactical missile. USAF was denied new funds to buy Mace, but has been authorized to divert money originally allocated to other projects.

Operation Cherrytree...

Recent USAF action in reappraising its air defense program indicates an awareness, however belated, of the fact that our military picture is changing rapidly.

Operation Cherrytree is another exercise badly needed to meet this problem. Top Air Force commanders are taking a hard look at weapon system development and production programs for the next decade during Cherrytree, a three-day session at Maxwell AFB, Alabama.

Purpose is to develop a realistic budget evaluation of the complete spectrum of USAF weapon systems from the research and development phase to the end of operational life. After two days of briefing, the group is to decide what programs will form the hard core of the Air Force weapon structure over the next ten years.

Savings through standardization...

Standardization of aircraft and missile parts, a result of the combined efforts of the National Aircraft Standards Committee of the Aerospace Industries Association and the Department of Defense, will effect huge savings and improved procurement efficiency. The parts standards apply to all services and their contractors, as well as the aircraft industry.

Perkins McGuire, Assistant Secretary of Defense for Supply and Logistics, recently stated that the cost of engineering documentation in the Department is estimated at $2 billion a year. Certainly the adoption of industry standards will sharply cut the amount spent on standards for aerospace procurement.

Missile briefs...

- Smaller version of the Minuteman, designated Midgetman, with reduced payload and range, may be proposed as a solid-propellant IRBM for NATO use.

- **Feasibility of fabricating** rocket engine nozzles from ablative materials at one-tenth or less the cost of present nozzles has been established by USAF-sponsored research. The ablative nozzle would deteriorate slowly enough to remain operable until burnout occurs. Present nozzle designs are very costly because of the extremely fine manufacturing tolerances required.

- **Navy has chosen** the Pratt & Whitney JTF10A-1 turbofan engine as the powerplant for its subsonic Missileer aircraft. The Missileer will be the launching platform for the Eagle air-to-air missile. Navy decision for a Missileer airframe is expected this month.

- **Latest estimate on the cost** of the Skybolt air-launched ballistic missile program is that it may involve almost a billion dollars over a ten-year period. This would include research, development, and production costs of the missile and modifications to the Boeing B-52s that will carry it.

Cutting-tool conversion...

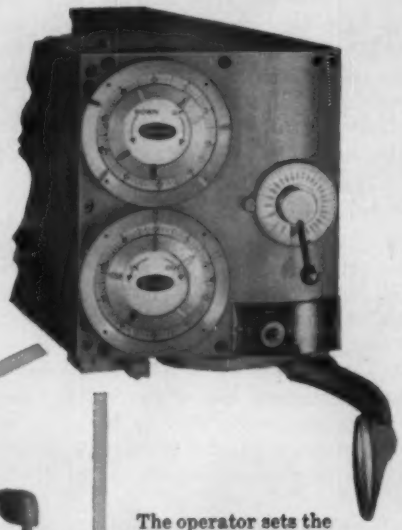
A new Air Force report outlines how to convert from single-piece, brazed-carbide cutting tools to throwaway tool in which thin inserts, fastened mechanically to the tool shank, serve as cutting edges. Production savings are pointed out in the report. Available from the Office of Technical Services, Commerce Department, Washington, DC, Report PB 161276 sells for $2.25.

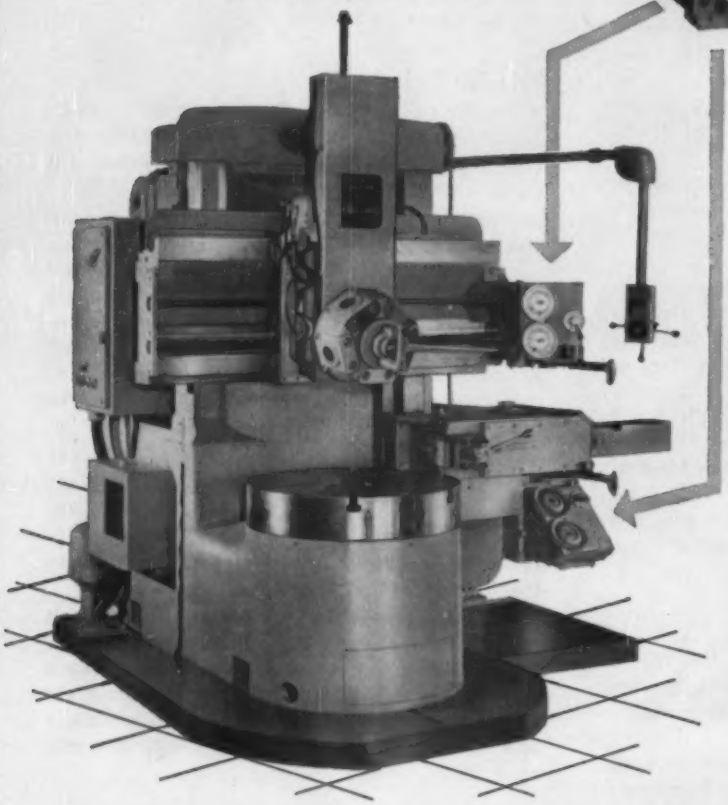
BULLARD

DYNATROL* V.T.L.

Obsoletes Handwheels

A completely new concept in measuring, utilizes large, easy to read, clock-type dials with dual pointers.





The operator sets the movable clips, around the dial, to conform with the workpiece requirements and by rotating the pointers to these settings he *knows* the tool is precisely located for the operation to be performed. The graduations and numerals remain stationary while the pointers rotate, one registering tenths of an inch and the other thousandths, for exact head positioning.

When coupled with the unique DYNATROL* control, this accurate measuring system eliminates the need for handwheels, for head-positioning, in either feed or traverse and increases the productive time of the machine.

* Trade Mark

Ask your Bullard Sales Representative about the many other features which make the Bullard DYNATROL* the *first* fully power-controlled vertical turret lathe.

THE BULLARD COMPANY, Bridgeport 9, Connecticut.

High-Spot Features of the DYNATROL* V.T.L.

Dynatrol V.T.L. is POWER CONTROLLED

By lever or pendant—it's your choice—head traverse rates can be varied from zero to nine feet per minute. Easy-to-read dials show exact position.

Feed selector gives infinitely variable feed rate without interrupting the cut.

Dynatrol V.T.L. is VERSATILE

Available equipment includes:

Bullard variable speed drive for infinitely variable table speeds throughout the full range with no loss of usable horsepower.

Fully automatic operation by Bullard Man-Au-Trol or point-to-point or continuous path numerical control systems.

Unique Size-Au-Trol* for accurate positioning of all heads. Contouring attachments: Hydraulic, electronic or electro-hydraulic. Four- or five-sided power-indexing turret heads. Thread cutting, drum scoring and angle turning attachment. Power-operated chucks.

Dynatrol V.T.L. is COMPACT

The new Bullard Dynatrol V.T.L. is compact in design, rigid in construction, lower in height, reduced in floor area.

Dynatrol V.T.L. is EASY TO MAINTAIN

Automatic lubrication throughout... fewer parts... fewer adjustments... easily accessible.

"YOU CAN'T BEAT A BULLARD"

MACHINE TOOLS...

Lathes for Argentina . . .

Export demand continues to provide an important share of business for many machine tool builders.

Recently sizable orders were placed with lathe makers and builders of other types of machines for delivery to the new Ford plant in Argentina. One lathe company is reported to have received an order for 30 or more machines.

Some builders are concentrating much of their current effort in Argentina rather than in other Latin American countries because dollars are available to local manufacturers.

Fiat buys American machines . . .

Sales of U S machine tools to European automobile companies still are thriving. Fiat for one is in the midst of an extensive expansion program that may result in doubling its capacity. It already has placed important orders with U S builders and further business is anticipated.

Opel is understood to have a fresh program in mind, though it has hardly completed its previous major expansion of facilities.

The success of U S builders in securing so much European automobile tooling business is believed to stem from two factors. One of them is that automobile makers abroad are tooling for higher production with automated equipment than they ever have before. Whereas labor used to be cheap and plentiful, hourly rates have climbed and a scarcity of labor exists. This combination gives extra attraction to mechanized high-production machines.

Another factor making for good business from Europe is the delivery situation. Never have the machine tool industries of western Europe been so prosperous, and hardly ever have their deliveries been longer. Shorter deliveries can be secured from U S builders.

Some U S machine tool companies with plants in western Europe have backlogs of one to one-and-a-half years in those plants.

US-European deals pending . . .

Negotiations for manufacture of U S machines in Europe and for European machines here on a licensing basis are still in progress.

A European maker of automatic screw machines is considering a licensing arrangement with a well-known U S builder who has not manufactured such machines heretofore.

An American builder has recently concluded an agreement with a German company for production of its larger machines. But this builder wants no formal publicity.

New pricing plan . . .

A midwest builder has hit on a pricing scheme that no other machine tool company is believed to have used. He is importing a general-purpose foreign machine and selling it in this country through his own distributor organization. At the same time he is preparing to make the foreign machine in his own plant too. The machine, whether made abroad or here, will be priced on the basis of averaging European and U S production costs. This means that it will be priced under comparable American machines but above the level that would be charged if only European costs had to be taken into account.

Japanese seeking license . . .

A Japanese builder of automatic lathes and of grinding machines is seeking a licensing agreement to manufacture similar types of U S machines and sell them in the Far East. A company representative is in the U S now.

A growing number of U S machine tool companies with European facilities are shipping machines to Canada from their European plants. Only in this way can the American builders meet prices quoted by German and British companies in particular.

To trade liquor for tools . . .

Mexico has negotiated an agreement with the Japanese whereby increasing amounts of Tequila, a potent liquor made from cactus, will be traded for machinery, including machine tools.

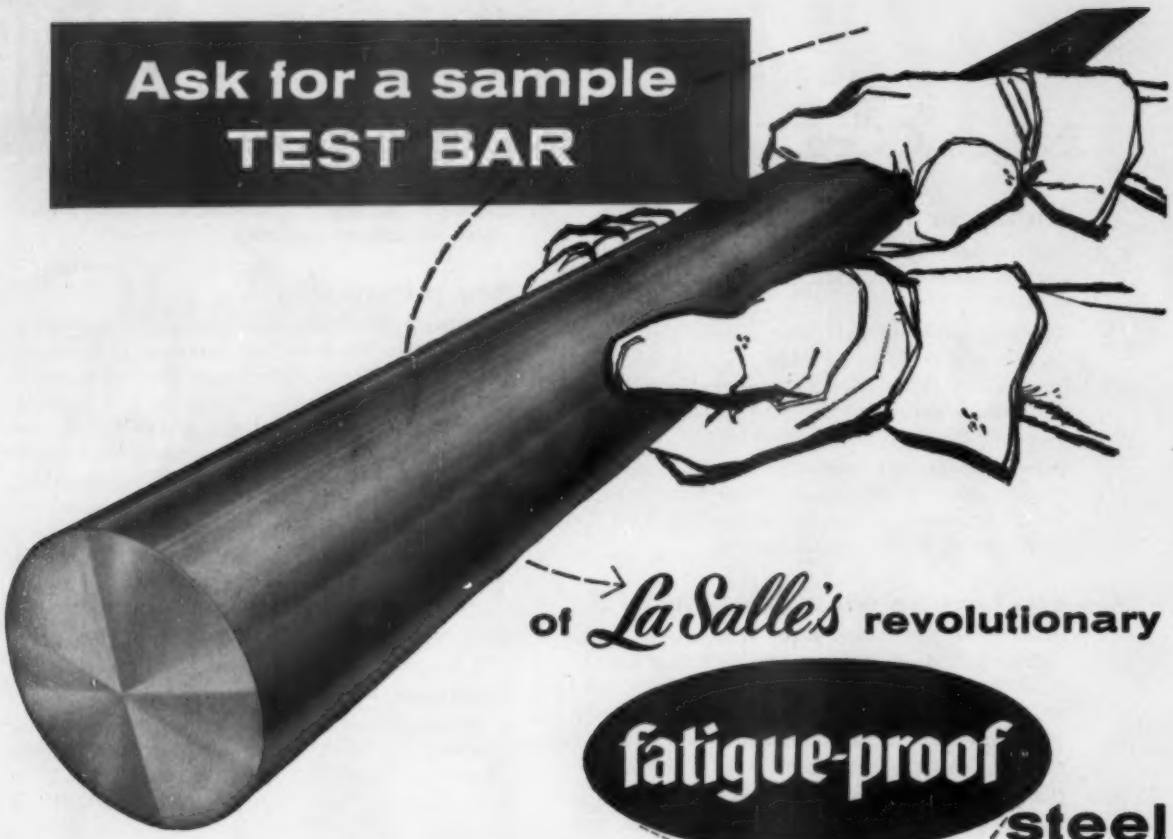
A spokesman for the Japanese Machinery Exhibit in Mexico City said that test amounts of Tequila will be distributed and promoted in Japan to see how the Japanese take to it. Japan is eager to sell machine tools in Mexico.

The Russians are going in heavily for barter agreements in connection with machine tool purchases. They are offering to take other commodities if buyers in other nations will order Soviet machines. Contrariwise, they are seeking to sell goods other than machine tools in payment for machine tools that they themselves may buy outside.

Several leading U S machine tool builders have been conducting on-the-ground investigations of the possibilities of doing business with Communist-bloc countries, including Russia.

BF.

Ask for a sample TEST BAR



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Elevated Temperature Drawing

The steel bar that has high strength WITHOUT HEAT TREATING

Yes, La Salle invites you to test a sample bar of the remarkable new FATIGUE-PROOF. This amazing new material is its own best recommendation . . . as proven by the many original equipment manufacturers who have already tested (and are using) FATIGUE-PROOF.

If you are making parts requiring strengths in the tensile range of 140,000 to 150,000 psi, and want to eliminate the expense or problems of heat treating . . . if you want to save production costs with a bar that machines faster (25% faster than annealed alloys—50% to 100% faster than heat treated alloys) and gives you a beautiful finish, too . . . if you want to improve the quality of your product while saving money, send us a blueprint, drop us a note giving application details, or better yet . . . pick up your telephone and call a La Salle sales engineer (REgent 4-7800, Chicago, Illinois).

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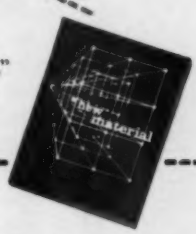
Get your copy of "a new material," a 24-page booklet which gives detailed information on La Salle "FATIGUE-PROOF"® steel bars.



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Manufacturers of America's Most Complete Line of Quality Cold-Finished Steel Bars

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MATERIALS...

Ice "Alloys"...

Ever notice that ice cubes don't stick together in an alcoholic beverage? Perhaps you don't care, but some folks at Massachusetts Institute of Technology think it's pretty significant. They're hard at work in the new Ice Research Laboratory, a part of MIT's Department of Metallurgy. Seems that ice and snow offer a useful structural material for exploitation and development of the earth's cold regions. They might be useful for bridges, warehouses, hangars, housing, etc—but in their natural state are too weak. Uses so far are at a "stone-age" level because no satisfactory processing has been developed.

Ice-sawdust mixtures were developed during World War II in connection with British plans to build a 2-million-ton aircraft carrier of ice. Adding 15% sawdust more than tripled the tensile strength of ice. Alcohol and other "lubricating" agents help ice grains fit together in a much more dense, hence stronger, structure.

MIT's Ice Research Laboratory is under the direction of Professor W David Kingery, a pioneer in the development of physical ceramics and widely known for his work in high-temperature technology. He has found, for example, that adding 4% by volume of glass fibers to ice increases its tensile strength 10 times—from 200 to 2000 psi.

Now considered mineral raw materials, ice and snow processing methods include solidification, mining, pulverizing, incorporating strengthening agents, and new construction methods—including welding. Dr Kingery predicts that engineers will be building practical structures out of ice in two to three years as a result of advancing research.

Of some significance to metalworking is the supposition that as development of the cold regions proceeds, some unique equipment will be needed for processing, construction, and support of the various projects. Philosophically, recognition of ice and snow as engineered structural materials is further proof that we can't be complacent about the search for better materials. Even scotch-on-the-rocks can give us answers we need.

Carbonyl...

Nickel carbonyl (see page 108) is not the only form of this compound. Other carbonyl compounds include tungsten, chromium, and iron. And the potential applications of these metal-bearing gases are legion.

Carbonyl is not a trade name. It is the chemical term used to describe either the bivalent radical CO, or a compound of this radical with a metal. In varying degrees, these compounds decompose, when heated, into the metal plus carbon-monoxide gas. From these gases it is possible to produce thin films, thick-wall shells, or metal powders. The metal is purer than when electrolytically applied, and more dense.

Honeycomb sandwich structures can be produced by a technique perfected at Carbonyl Metal Products/The Budd Co, Conshohocken, Pa. Bubbles of Pyrex glass are placed between two sheets of sandwich metal, the assembly is heated, and carbonyl gas is pumped through it. Metal deposits on the glass bubbles until all of the spaces are filled with a solid network of metal. A Budd spokesman says the honeycomb could sell for $20 to $25 per sq ft.

Saving tool steel...

Expensive tool-steel alloys are being welded to less costly mild steel to form a composite die section. Thus, less tool steel is used and less work is required to machine the die into shape.

Tool steel, used only on the working or cutting edge of the die, is usually cut or shaped to the desired design prior to welding. These composite dies, used in the automotive and appliance industries are reported to be saving 25% over similar, solid tool-steel dies.

Welding is accomplished by a giant welder developed by Allegheny Ludlum Steel Corp's Forging and Casting Div plant near Detroit. It will weld an area of 150 sq in. in seconds. Combining high heat and intense pressure to electrically butt weld the two metals, the welded seam is hardly visible after cooling. Maximum pressure is 1600 psi and heat-power supply is 750 KVA. Shapes up to 15 in. high and 18 in. long can be handled.

Titanium heat exchanger...

Serving as a heat exchanger and conveyor for handling hot, highly corrosive sodium hypochlorite at the Kuehue Chemical Co, Elizabeth, NJ, titanium is proving extremely successful. In operation three years, the titanium shows no effects of corrosion. According to the user, the sodium hypochlorite solution enters the tubing at temperatures up to 100 F. It emerges within one degree of the temperature of the input cooling water contained in the galvanized-steel-pipe jacket surrounding the tubing. The titanium used in the tubing was Republic Steel Corp's RS-55 grade.

You don't have to see the "Red End" to know it's a

SIMONDS

HACKSAW BLADE

Just put it to work ... that's all!

Performance speaks for itself. And if you think there's no difference in hacksaw blades, try this:

TEST 1 BOX OF 10 SIMONDS "RED END" BLADES AGAINST ANY 10 OTHERS

Then you'll know you're getting more for your hacksaw dollar than you ever got before. And then you'll see why so many other hacksaw users "Say Simonds and Save!"

Simonds "Red End" Power Blades come in All-Hard and Shatterproof types in all standard lengths, thicknesses and tooth spacings . . . a "right" blade for every job! Three types of Hand Blades are also furnished in all standard specifications for best results at lowest cost.

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Your nearby SIMONDS DISTRIBUTOR is your most dependable cutting tool supply source. His stocks and services are designed with your convenience and economy in mind. Call him FIRST for all your industrial supply needs!

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WHAT'S AHEAD... in Metalworking

TRENDS

Metalworking production pace holding steady...

Inventories in the nation's steel service centers are nearing 3.2 million tons, the Steel Service Center Institute reports, and a nearly balanced condition exists throughout the country. The Institute considers 3.4 million tons a well-balanced inventory and feels that this level will be reached in the next two or three weeks.

Steel mills in the Chicago and Cleveland areas have made some cutbacks, will probably make more. Despite high stocks of unsold cars, automakers are still scheduling high rates of production through April. Unless auto sales pick up, steel orders may slump this summer.

Latest reports from the nation's foundry industry show the steel founders doing a good business, with an operating rate of 57.4%, a healthy increase above earlier figures. Operating rate for gray iron founders hit 84% of maximum demand, but the situation is considered "very unusual" with a few founders working six days, some others working only three days.

Replacement sales of automotive parts is reported continuing at the same high level as in 1959, and this represented a 20% increase for producers.

Cutting tool sales are up. Increases of 15% and 20% over a year ago are reported by two major producers. Both companies report good, steadily growing backlogs.

Few railroad car orders were placed in the last month. Business is static, anticipating upcoming labor negotiations. If the labor problems can be settled, 1960 could be a big year.

Sheetmetal shops report business at a 1959 level, though static at the moment. No change has occurred since January, reports one fabricator. His backlog is down 20% from this time last year, but he expects 1960 sales to be 5 to 10% better than 1959.

Bearing production and sales are holding steady, with the exception of one manufacturer that reports sales down 15 to 20% from January-February levels. Others report sales increases of 15-25%, and expects sales for the year to be up slightly over 1959.

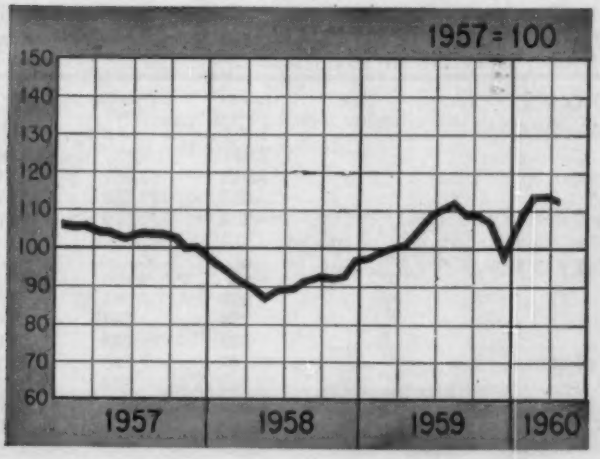
Furnace manufacturers present a mixed pattern. One reports business up 15% from last year, up 18% since January, and an increasing backlog. Another says business is static at the moment but down 50% since this time last year. Still another reports that the trend is downward. This company's expectation for a boom year in 1960 has diminshed over the past three months. Greatest interest is in furnaces for high-temperature applications, up to 5000 F, and for vacuum furnaces.

Appliance sales continue healthy. Business is now expected to be equal to that in 1959 with major appliance sales showing a definite gain.

The American Gear Manufacturers Association's latest index report shows a 14.5% increase in monthly bookings and an 11% increase in shipments. And both figures are well above 1959 levels.

Tool and die manufacturers in the southeast are optimistic for 1960—and some of them have good reason to be. One reports business about 50% ahead of last year. Most of it was automotive, but should this slump, the slack can be taken up with orders from appliance makers.

Another tool and die shop in this area says business is up 400% and should continue at this merry pace until mid-year. Expectation for the year: a good 100% increase.

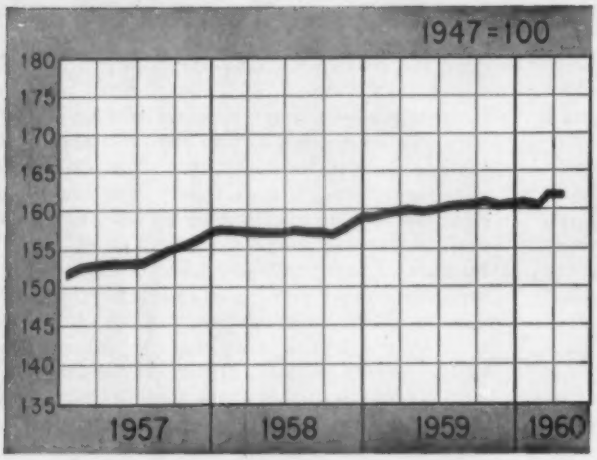


AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	MAR. Estimated	FEB. Preliminary	JAN. Revised	FEB. Year Ago
Total Index	**108**	**109**	**109**	**98**
Machinery	105	106		90
Electrical Machinery	115	117		100
Autos	125	127		97
Other Transportation	87	88		94
Other Metalworking .	113	111		100

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	MAR. Estimated	FEB. Preliminary	JAN. Revised	FEB. Year Ago
Total Index	**160.4**	**160.5**	**159.6**	**158.4**
Metalworking Machinery	**190.1**	**189.8**	**182.6**	
Other Machinery exc. Electrical	**175.0**	**172.4**	**169.9**	
Electrical Machinery	**162.9**	**162.4**	**158.6**	
Fabricated Metal Products	**148.0**	**148.0**	**148.7**	

Good news from consumers . . .

Sales of major consumer durables should show a substantial improvement in the months ahead. That's one conclusion that follows from the results of the latest survey of consumer attitudes, recently released by the University of Michigan Survey Research Center.

The number of consumers planning to buy new automobiles and other durables is substantially greater than a year ago. The sharp increase in auto sales registered in the early days of spring should, therefore, prove to be more than a temporary pickup. Sales of new cars should continue at a brisk pace well into 1960. Consumer plans to purchase new homes also are strong, and will give general business a steady boost.

One reason for the improvement in consumer attitude is that a greater number of families expect to be better off financially in the future. Three-fourths of the consumers surveyed expect business to be good in the months ahead. They thus feel secure in their jobs. In addition, a greater number of consumers have savings and other assets that put them in a better position to buy. Over-all, consumers haven't been so well off financially since 1956.

Last month's turnabout in auto sales didn't boost output enough to prevent another slip in industrial production in March. But overall industrial output, as measured by the index of industrial production, has about halted its slide, and should turn up this summer.

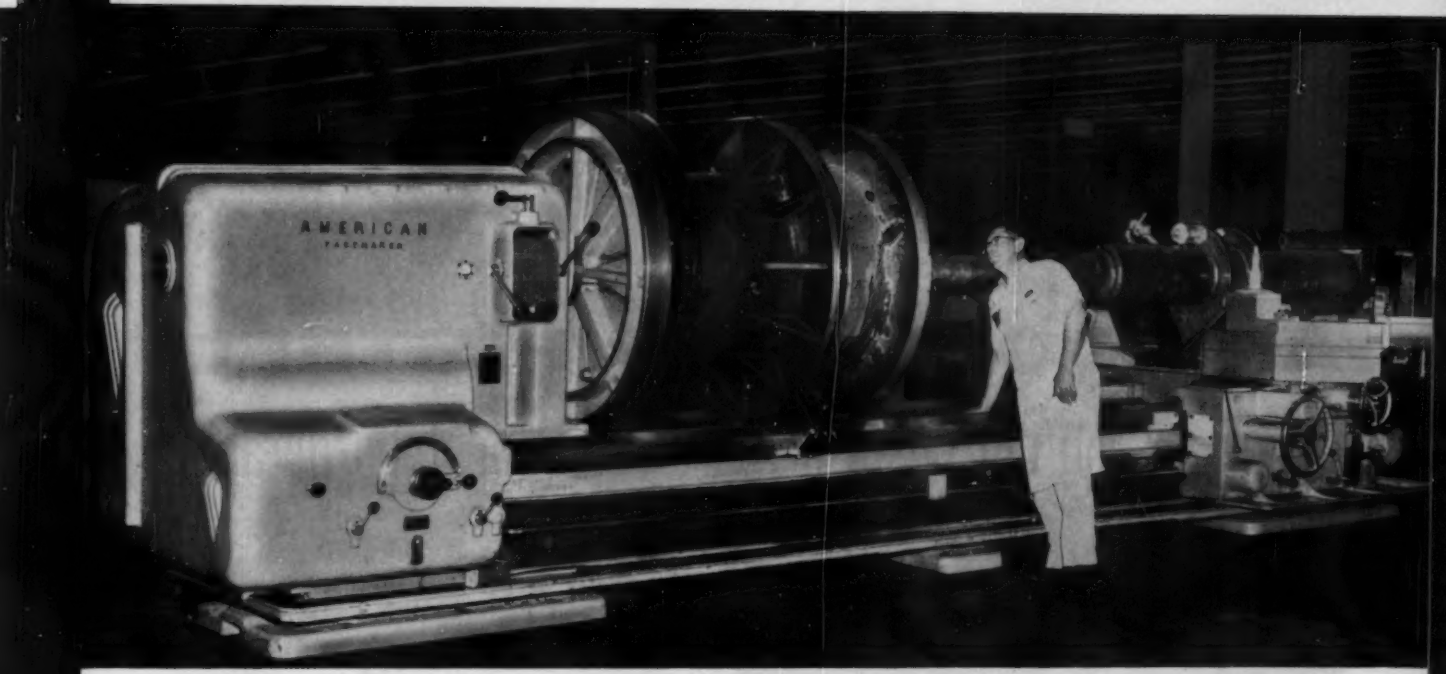
Another factor that will be making for increased consumer spending is easier money. Costs of borrowing haven't declined, but loans are far easier to obtain than just a few months ago. And credit should ease even further in the months ahead, as the federal budget surplus is used to pay off government debt.

Consumers thus will be able to count on banks to provide much of the credit they need to finance cars and appliances, as well as new homes.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	155.8	156.6	148.6
Steel ingot production (thousand tons)	2,447	2,527	2,641
Electric power output (million Kilowatt hours)	13,542	13,951	12,618
Production of automobiles and trucks	155,055	137,385	133,878
Engineering construction awards (Eng. News-Record, millions)	356,204	383,619	469,854

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	267	283	256
Vacuum cleaners sales (thousands of units)	258	294	243
Washers sales (thousands of units)	203	264	288
Household electric ranges sales (thousands of units)	67	80	79
Radio production (thousands of units)	1,353	972	1,125
Television production (thousands of units)	525	593	437
Gear sales index (1947-49=100)	243.4	233.9	218.6
Foundry equipment new orders index (shipments, 1947-49=100)	95.5	95.9	127.4

*Seasonally adjusted

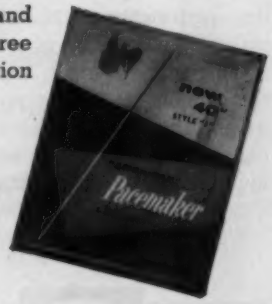


HERE'S THE *VISUAL* ANSWER!

Any question about the capacity of "AMERICAN" Lathe Spindle bearings or the stiffness of "AMERICAN" Spindles is certainly answered by this illustration.

Here is a 40" "J-9" "AMERICAN" Deluxe Model Hydraulic Duplicating Lathe (one of three, 40" "J" "AMERICANS") in the Charlotte, North Carolina plant of the Douglas Aircraft Company, Inc., boring a 54" diameter bulge die weighing five (5) tons. This illustration shows an ingenious roller rest made by Douglas but on many operations no steady rest is used.

This is a 60 horse power lathe with spindle and spindle bearings of tremendous capacities, consequently is ideally adapted to "elephant" operations of this nature and there are other exclusive design features contributing to the excellence of this big lathe, such as the extremely rigid 4-vee bed; the brand new massive 7½" diameter spindle tailstock; the patented three bearing, triple drive spindle; its 100% anti-friction construction and full automatic oiling.



The many ultra modern and superlative features of "AMERICAN" Deluxe Model Pacemakers are described and thoroughly illustrated by bulletin No. 150. May we send you one?

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

CIRCLE 238 READER SERVICE CARD

ARMCO STEELS / for better products • lower costs

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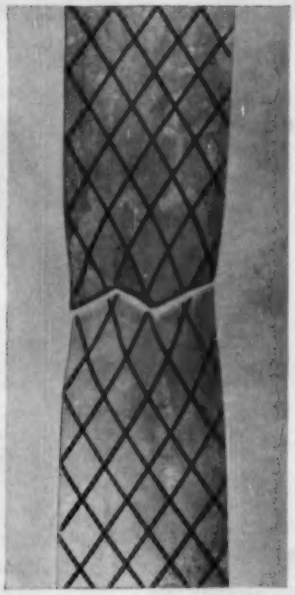
ARMCO ZINCGRIP STEEL

may help you cut costs of parts that must be durable

Production forming and laboratory tests demonstrate that the special hot-dip coating on Armco ZINCGRIP won't flake or peel.

Drawing, forming, piercing and interlocking operations don't impair the protective value of this ZINCGRIP part.

This tensile test specimen shows that right up to the fracture, where the metal stretches 60-70%, the coating on ZINCGRIP stays on.



These photographs show how far ZINCGRIP can be stretched and formed without damaging its tightly adherent mill-applied zinc coating. For the past 25 years this performance has been demonstrated in plants making a wide range of parts from ZINCGRIP.

This special Armco Steel enables you to give parts the economical lasting protection of a uniform, full-weight zinc coating. For example, parts you are now plating or painting may be made of ZINCGRIP at much lower cost. For only a few cents' premium over cold-rolled steel, ZINCGRIP creates the possibility of eliminating not only plating or painting but the necessary cleaning and inspection those operations entail.

Because you can put this special Armco Steel through regular production lines without damaging the protective zinc coating, manufacturing costs are low. Let us send you complete information on Armco ZINCGRIP Steel so you can evaluate its advantages for your products. Write Armco Steel Corporation, 1470 Curtis Street, Middletown, Ohio.

ARMCO STEEL

Armco Division • Sheffield Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation

American Machinist / Metalworking Manufacturing ESTABLISHED 1877

What Is the Army Trying to Hide?

Just what is the U S Army up to? Its job, among other things, is to develop and produce nuclear-age weapons in the desired volume within the specified time at a cost the nation can afford.

With its present production equipment it is incapable of doing this job efficiently. It cannot hope to do it unless it immediately puts into effect a machine tool modernization program.

This program would consist of installing in its facilities 5000 to 6500 new machines of today's advanced designs every year for many years ahead.

Without such modernization, development of new weapons will lag, costs will soar because of the rapidly deteriorating efficiency of obsolete machines, and leadtime for machine tool procurement in the next emergency will rise to 30 months or more, compared with 24 months during Korea.

A Johns Hopkins University . . .

research team arrived at this grim prospect nearly a year ago after a study of the Army's and the nation's production base. Main conclusions of the study were first published in AMERICAN MACHINIST/METALWORKING MANUFACTURING in July 1959.

Now that the study officially has reached the Army's top brass, it has been marked "classified." This means that the Army regards the study as a military secret or deliberately wants to hide its revelations. In either case, the Army is trying to maintain the fiction that the study's main findings have never been disclosed.

Who and what are responsible for this astounding attitude? Is the Army attempting to conceal the fact that you cannot have modern weapons without modern means of production?

Doesn't it wish people to know that its production facilities are out-of-date and that it is doing nothing to correct a dangerous situation? Is it the Army's custom to deal with constructive criticism by suppressing it?

The facts turned up by the Johns Hopkins study are devastating. Nine out of ten of the Army's machine tools were built either in World War II or during Korea. They are older than that in design. They fall deplorably below the capabilities of today's machines to meet required production performance at a reasonable cost.

The Army is not taking . . .

advantage of the vast benefits to be derived from using today's impressive improvements in metalworking technology, the study reveals. Military applications of this technology are potentially numerous. Design itself and translation of engineering changes in complex military equipment into actual production can be speeded immeasurably by such applications.

Most devastating of all in the Johns Hopkins study is the conclusion that obsolescence and wear rule out a large proportion of the nation's available machine tools as capable of meeting requirements of a modern military organization. Only a fraction of these machine tools can do an efficient job of producing today's and tomorrow's advanced weapons.

Rather than shroud in secrecy . . .

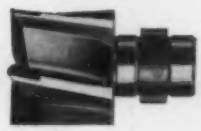
the Johns Hopkins documentation of facts, the Army should immediately declassify it and use it as prime evidence for putting into effect a modernization program before it is too late.

Unless the Army takes this action, it will have to bear full responsibility for an amazingly callous disinterest in keeping its production base abreast of today's technology.

Burnham Finney EDITOR

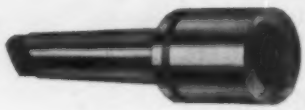
6 Features that make a big difference in counterboring operations!

1. HAND DETACHABLE . . . a twist of the wrist engages or releases the cutter after the severest cutting operation.

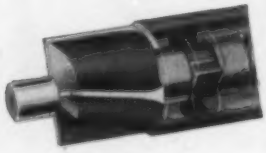


4. BALANCED DRIVE . . . double bearings—one on each side of drive lug—provide extra rigidity.

2. STURDY DRIVE . . . diametrically opposed drive lugs engage corresponding abutments in the holder.

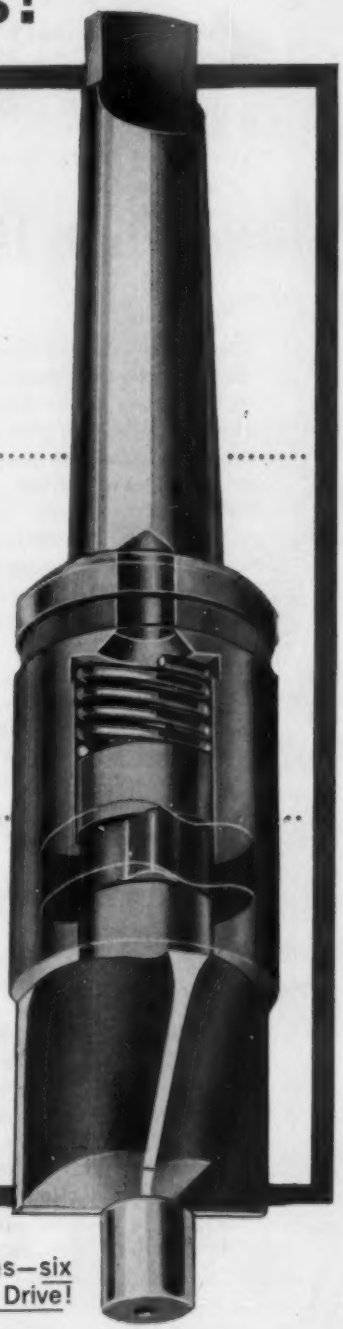


5. FREE FROM OBSTRUCTIONS . . . holder body slips easily into a bushing or can be threaded for stop nuts or collars or fluted for lubrication.



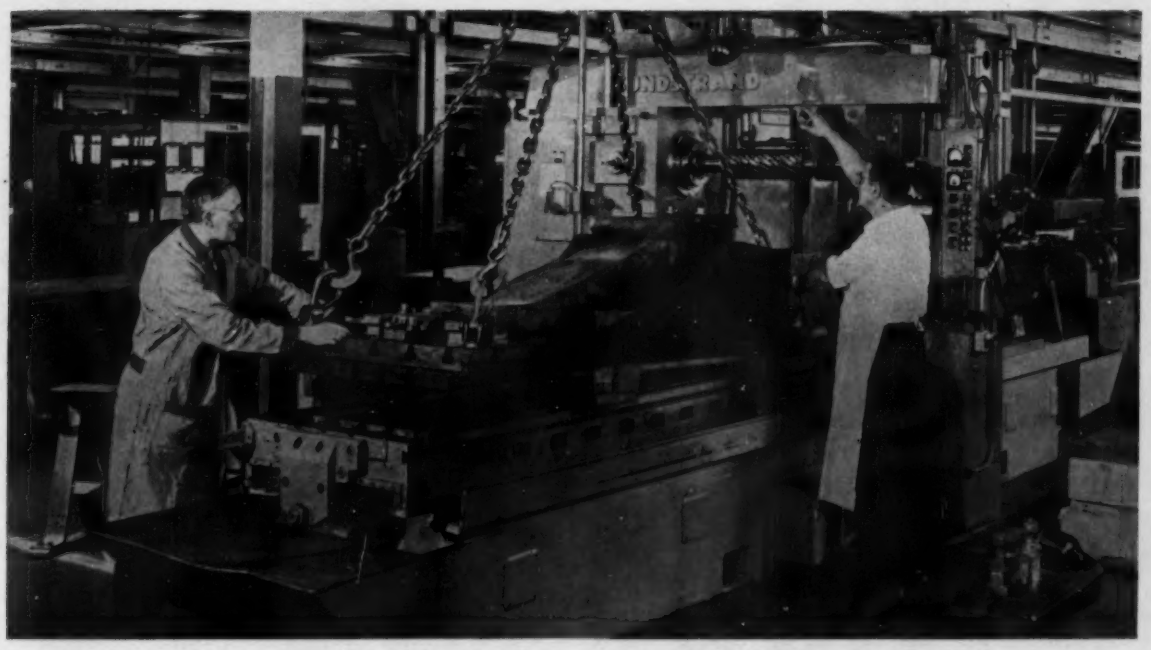
3. EXTRA TORSIONAL RIGIDITY . . . drive lugs are close to seating shoulder of cutter for powerful, smooth operation.

6. PRACTICALLY INDESTRUCTIBLE . . . no binding, no shearing—driving forces apply compression.



These are the features that make the difference in counterbores—six reasons why no one reports failure of a Continental Counterbore Drive!

Continental CTW TOOL WORKS DIVISION OF EX-CELL-O CORPORATION DETROIT 32, MICHIGAN 60-45



Job setup time on this tracer-controlled Sundstrand miller averages less than 15 minutes—because the work and control templet are bolted to the setup plate in another area (see photo below) before it goes on machine table

Cut that machine setup downtime!

By Fred Adamson,
General superintendent,
Special Products & Tool Manufacturing
A O Smith Corp,
Milwaukee

At away-from-machine setup area (for the Sundstrand miller in photo at top of page), the next job is clamped onto a setup plate. Meanwhile, machine itself is completing previous job, or is being reset for the job shown here

Machine tools don't earn a plug nickel when they're down for setup. That's scarcely news, but how many shops have found a way to cut setup downtime to the bone on such big machines as bed or planer-millers, planers and jig borers? When these machines aren't cutting chips, they're nothing more than expensive layout tables.

Moving its tool operations into a new plant recently, A O Smith Corp decided to do something about the downtime problem in tooling two large milling machines: a heavy-duty Ingersoll planer mill with 46 x 264-in. table, and a special tracer-controlled, rise-and-fall Sundstrand with a 30 x 132-in. table.

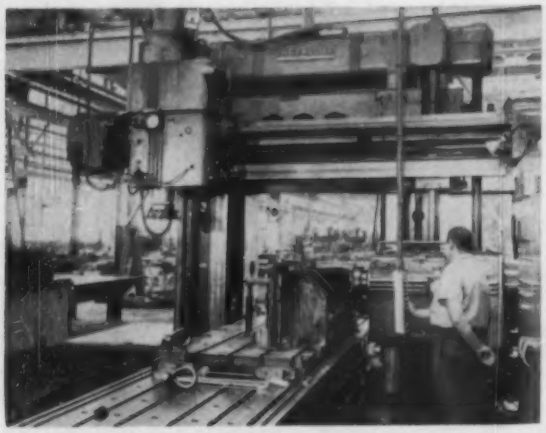
The solution: three steel setup plates for each machine. These plates were machined to provide T-bolt slots in their top faces, alignment keys in the bottom faces, and tapped holes for lifting lugs or eyebolts. Schedules were, and are, arranged so that jobs could be set up on auxiliary plates, while other jobs were in process on the machines.

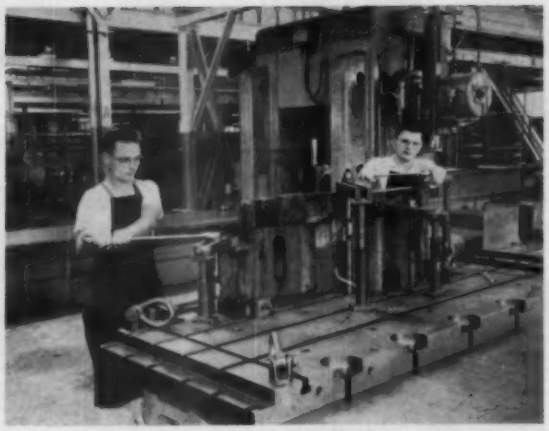
Today, jobs that normally required one to three hours for setup on these same machines, now average 15 minutes setup time (exclusive, of course, of the time required to prepare the auxiliary plate).

All setup work on the auxiliary plates is done away from the machine by regularly assigned setup men and their helpers, who are supervised by the machine's regular operator. When an auxiliary plate goes onto the machine bed, the operator, who is responsible for the setup, assists in aligning the plates with T slots.

(Continued on next page)

Cut setup downtime . . .





Auxiliary setups for an Ingersoll planer-miller . . .

Work mounted on setup plate is easily aligned on this planer-miller's 46 x 264-in. table. Next job is mounted on a similar plate, while the machine is doing the job shown here. Plate can be reversed on table if necessary

Two setup plates not in use on the Ingersoll machine are placed on adjacent surface plate for loading and unloading. Third setup plate is on the machine table with the job in process. Time saved: one to three hours per setup

Each of the plant's more-expensive machine tools has assigned to it a complete set of setup tools—jacks, blocks, clamps, parallel bars, cutting tools, and special attachments—which are kept in cabinets adjacent to the machine. Some machines (the Ingersoll mill is one) have their own jib and bridge cranes. Those machines using the auxiliary plate technique not only have setup tools at the machine, but at the auxiliary plate setup area, too.

The idea of cutting setup downtime with auxiliary plates is not new. During World War II, a number of floor-type horizontal bar machines and large vertical boring mills were equipped with setup plates at the Joshua Hendey Iron Works, Sunnyvale, Calif, to speed production of engines and auxiliary equipment for Liberty ships.

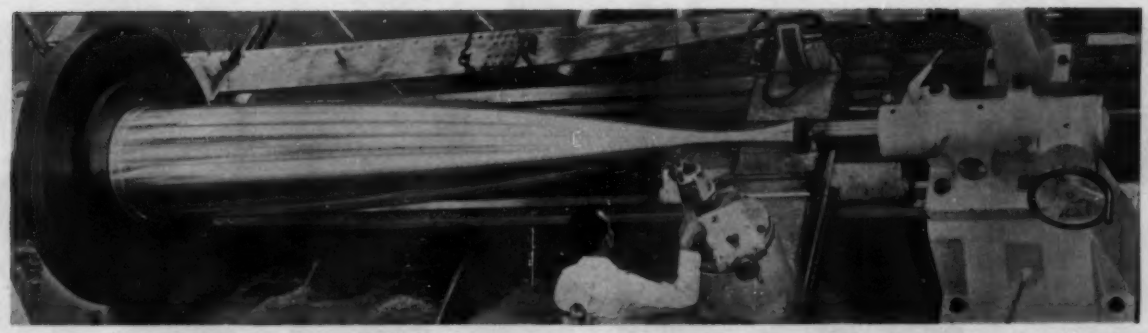
All setup operations for these machines were performed at adjacent workstands, and the machines were shut down just long enough to change the setup plates.

More recently, interchangeable fixtures have been used at Allis-Chalmers' LaPorte Works for locating large weldments for milling and drilling operations. Here, setup fixtures moved from the setup stand to a special planer-miller, then to a tunnel-type multi-spindle drilling machine, and back to the setup stand for unloading and reloading. Fixtures were quickly aligned on each machine and on the setup stand with matching diamond-shaped pins and hardened bushings.

Sorter unscrambles look-alike metals

Such reactor metals as Inconel and stainless look so much alike that they can easily become mixed during fabrication. Now, GE's Atomic Power Lab has come up with a metal sorter that identifies them quickly. The $300 unit consists of six small meters, and is basically a standard milliammeter with one clamp-on lead, and a lead with a small carbon steel file at the end. Clamp-on lead is attached to the metal (see photo) and the file is rubbed against the metal, generating a tiny current (5 to 10 milliamps for Inconel or stainless), which is recorded on meter's dial. Metals record differently because their polarity is different with respect to carbon steel. Such other metals as Zircaloy 2, zirconium, and hafnium can also be unscrambled.

The meter may also one day be employed to check thermocouple leads and completeness of circuits.



Massive aluminum hand forging is finish machined on a Sidney tracer lathe. Finished part, twelve feet long and tapering from 24 in. in diameter at one end to 3 in. at the other, is used as a removable mandrel for electroforming a ⅝-in.-thick nickel shell that forms part of Douglas Aircraft's new hypersonic wind tunnel

Electroforming eliminates deep contour boring

When engineers at Douglas Aircraft were designing what is to be the aircraft industry's first major hypersonic wind tunnel, they were faced with the problem of fabricating the tunnel nozzle liner—a 12-ft-long shell that tapers non-linearly from 24 in. diameter at one end to 3 in. at the other. Furthermore it had to be made from a heat-resistant, high-strength material. To machine it from the solid would involve intricate contour boring to a depth of almost twelve feet, to an accuracy (0.001-in. radius tolerance) and surface finish (16-32 microinches) considered well beyond precision work for a piece of such material and such size.

Electroforming over a removable mandrel proved the solution. The mandrel could be precision machined externally, thus eliminating the tricky boring operation, and it need not be made of a high-strength material. Moreover, the removable mandrel can be reused to form additional liners.

Nickel, because of its strength and thermal properties, was chosen for the liner material; an aluminum forging, for the mandrel. The aluminum mandrel (alloy 2014) was forged between flat dies on a 8000-ton hydraulic forging press at Alcoa's Cleveland works.

Rough machining

Following ultrasonic inspection, the 8230-lb forging was sent to Hillcrest Crankshaft and Machine Corp, Titusville, Pa, where the OD was rough machined on a 42-in. Niles lathe and the ID was step-bored on a horizontal boring mill.

Then the piece was returned to Alcoa for solution heat treating and artificial aging. (Hardening only after the rough machining eliminated any possibility of creep or warpage from residual stresses set up by rough machining.) After this thermal treatment, the part was ultrasonically inspected once more, then shipped to Douglas' El Segundo Division at Torrance, Calif.

Here, on a Sidney tracer lathe, the mandrel was machined to its final dimensions. First, a cut was made to sever the mandrel at the venturi, or throat, section. The small, cut-off end was rejoined by running a bolt through the smaller part, and threading it tightly into an insert placed in the larger part. Dowel pins were used to lock the parts against rotation. This joint permits the two parts of the mandrel to be separated and withdrawn after the electroforming operation. Mating surfaces at the joint had to match perfectly so as not to interrupt the electroplating at this most critical point.

Finish machining

Total machining time at Douglas ran to three weeks. The finish cut took twenty-nine hours of uninterrupted machining at 61 rpm, with an 0.0085-in. cut and a feed of somewhat over 0.001 ipr. After slight hand polishing, the final finish was 16 microinches or better at the throat and 32 microinches or better on the rest of the mandrel. Radius tolerance of 0.001 in. was held at each of 1440 gaging stations.

Electroforming was done by Bone Engineering Corp, Glendale, Calif. Size of the liner necessitated a 17-ft vertical plating tank incorporating an agitating mechanism to keep the mandrel moving during the full plating cycle. The mandrel ends were sealed with gaskets, then the mandrel was put through a pretreatment etch to clean and prepare the surface for plating and to facilitate subsequent separation from the liner.

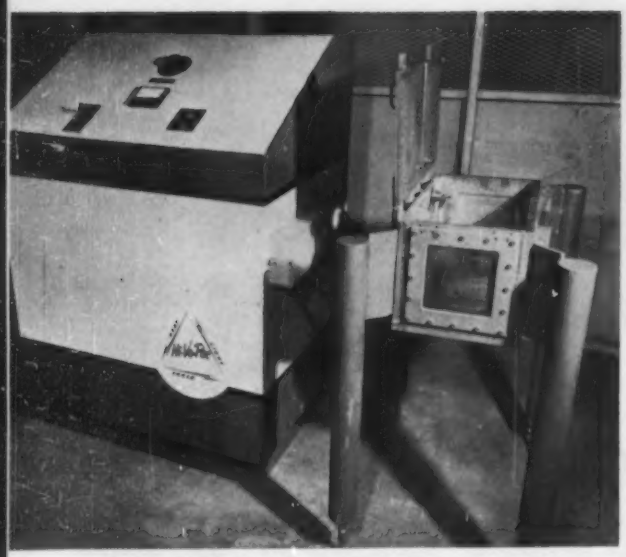
Six-week plating cycle

Plating took six weeks. During this time, daily analyses were made to insure constant solution properties, and daily checks were made on the physical properties of the nickel deposited on test specimens immersed with the mandrel. Continuous circulation through a filtration system maintained the purity of the plating bath.

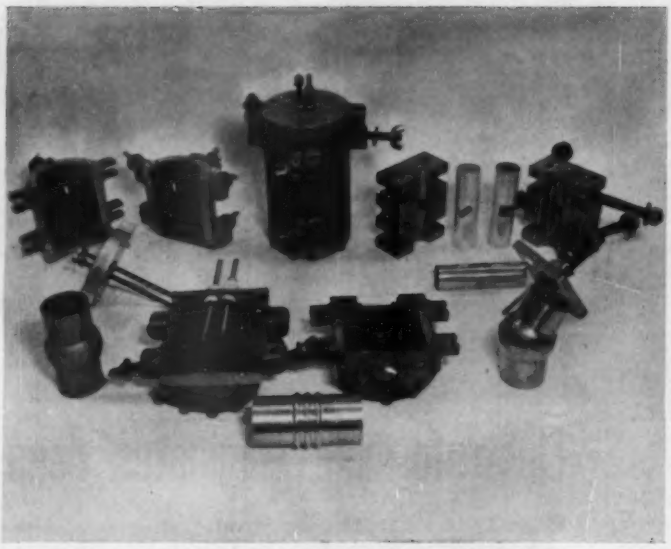
Several times during the six weeks, the mandrel with its partially completed liner was removed from the bath for inspection. The characteristic nodules of deposited nickel on the surface were polished off, the nickel-plated mandrel re-etched, then re-immersed in the bath. Re-etching assures a homogeneous blend of the subsequent plate to that already formed.

When the depth of deposited nickel exceeded ⅝ inch, the mandrel-liner assembly was removed from the bath and stress relieved, then returned to Douglas for cleanup of the external surface and cutting of the buttress threads needed for assembly into the wind tunnel.

Final operations took place at Bone, the first being the separation of the nickel liner from the mandrel. When subjected to sub-zero temperature, the mandrel and liner separated because of the difference in their thermal contraction. The bolt was then removed and the two mandrel sections were withdrawn, leaving the perfectly formed liner ready for installation in Douglas' Mach 6 wind tunnel nozzle.



High-energy forming through underwater discharge of a high-voltage spark is achieved in this unit developed by Convair-Fort Worth. Unit is safe for in-plant operation



Closed forming dies make full use of high pressures. Dies are made by pouring epoxy resin between pattern and steel shell. Electrodes extend up through die cover plate

"Packaged lightning"

Dynamite's successor in high-energy forming?

Electricity as a substitute for dynamite! That's the basis of Convair's latest development in the field of high-energy-rate forming — Hi-Vo-Pac. No laboratory wonder, though not yet available to industry, Hi-Vo-Pac discharges a high-voltage spark underwater, creating a high-energy shock wave that forms metal parts to the inner contours of a closed die.

While using a high-energy spark unit to study shock waves and wave forms in connection with explosive forming, Convair engineers realized that they had in their hands a distinct and vast source of controlled high energy. Here was explosive forming that could be used indoors.

Initial forming work involved the discharge of a high-voltage spark from a bank of capacitors. Voltages ranged from 14,000 to 22,000 volts; capacitance from 30 to 60 microfarads. The spark generated pressures in excess of 80,000 psi, sufficient to form small stainless, copper, and aluminum parts.

When additional work indicated that more power was needed, voltage was cut to 4000 volts, capacitance increased to 1200 mfd, and an initiating wire was attached between electrodes. (Reduced voltage also eliminated corona losses, making for a safer unit).

How it works

The energy stored in the capacitor bank is equal to 10,800 ft-lb. When Hi-Vo-Pac is fired, the initiating wire connecting the electrodes is transformed into a cylinder of metallic vapor. This vapor expands against the surrounding water, the inertia of which causes a pressure buildup of about 15 to 20 atmospheres. (Other investigators report that a tungsten wire, upon vaporizing, increases its original volume by more than 25,000 times.)

The Hi-Vo-Pac unit consists of a portable metal box containing capacitors, switching circuits, a power-regulating variac, charging switch, and manual or automatic discharge switches. Once the desired power setting has been made, you merely push the release button. In six seconds the unit charges, then automatically discharges. Hi-Vo-Pac is sufficiently safe for in-plant operation by non-technical personnel.

Die design

The most obvious difference from explosive forming is in die design. Dies for high-energy-spark forming are completely closed. The photo at the upper right shows several dies for forming airframe components. Electrode position is determined by the type of wave form found most efficient for the job. Wave form can also be varied by shaping the wire; sharp-nosed, spherical, and other wave fronts have been observed, and each can be put to use for a specific forming job.

Each die has its own set of electrodes and initiating wire. The dies can be completely closed because the volume of gas generated by the vaporized wire is insignificant, especially when compared to the gas bubble created by a chemical explosive. With a closed die, you get the full advantage of the pressure wave. In the case of tubular parts, the shock wave is reflected off the ends, providing additional energy.

Epoxy dies

Because of their high compression strength and reasonable wear characteristics, epoxies have been used in the dies at Convair-Fort Worth. A pattern of the part to be formed is positioned in a steel shell, and epoxy resin poured around it.

The die must be vibrated while the resin is being poured to expel all trapped air from the resin. In about two days the resins have cured and the die is ready for use.

Forming a part requires only the following simple steps: Close the split die and attach the bottom plate. Insert a rubber wafer in the bottom of the tubular blank, making it water tight, then place the blank in the die cavity and fill the tube with water. Now attach the cover plate, to which are attached the electrodes and the initiating wire. Connect the leads from the power unit to the electrodes, and push the release button. Hi-Vo-Pac does the rest.

Applications

In presenting this new forming technique at the SAE National Aeronautic Meeting in New York, E W Feddersen, chief of manufacturing research and development at Convair-Fort Worth, pointed out that Republic Aviation Corp (*AM*—Oct 19 '59, p123) and Chrysler Corp have been working on similar developments. He noted that high-energy spark, like explosive forming, obviously lends itself to expanding and sizing hollow shapes. So far, this is the most economical application. This new technique, he predicted, will take its place among the other production processes in sheet-metal fabricating shops throughout the metalworking industry.

What's next?

Explosive, pneumatic, and high-voltage forming methods are now in operation. Now, investigations are centering upon magnetic and ultrasonic energy (*AM*—Nov 16 '59, p2) as possible sources of energy for high-energy-rate forming.

What is the goal of manufacturing research?

Who makes the best manufacturing-research man?

This question, examined thoroughly by a special SAE panel at a recent meeting in New York, produced this composite ideal:

- He must have an inquiring mind.
- He must be open-minded, but also down to earth (that is, a practical businessman).
- He won't take "No" for an answer.
- If he has a mechanical or engineering background, he's usually better suited for MR than the scientific, pure-research type.
- He must want to be in manufacturing research.
- If he has had experience in manufacturing methods, he's much better qualified for the job.

Part of SAE's National Aeronautic Meeting (Apr 4-8), the panel met to discuss the topic, "How to Manage and Control Manufacturing Research." To provide full coverage of this subject, panel speakers presented four different views of MR, as practiced in four companies. Each concept, determined largely by the company's product, differs from the others—and each is valid.

MR as all-inclusive

Manufacturing Research includes study in all branches of manufacturing: machines, materials, methods, and men. That's the viewpoint of Arthur D Little, Inc. The best MR setup, according to Henry Little of this research firm, includes representatives from several departments in the plant. One of the group should be a secretary who acts simply as a monitor—not a leader.

Physical location of the MR setup, Little feels, should be separate from manufacturing, but not isolated from it. And the machines should include regular production units. It's important that production know what's going on in manufacturing research, and that the two be tied closely together. In the ideal setup, the production superintendent or foreman is responsible not only for his own machines but for those in the MR section.

Who should have the authority to budget and to evaluate a company's MR program. Little's answer: "An honest engineer—if you can find him—is the best appraiser of an MR program."

Little had one further piece of advice: "Don't hire a consultant and ask him to take charge of your program. Make him a valuable member of your staff, but don't ask him to run the program." Reasoning here is that company personnel should assume responsibility for the MR system.

MR as product improvement

In a multi-plant company that makes a wide variety of products, manufacturing research usually concentrates on product improvement: redesign of existing products or development of new ones. That's the situation at American Hardware Corp (New Britain, Conn), according to Director of Mfg Robert Parrett. The company's eight plants make 50,000 different parts a year for a wide assortment of builders' hardware.

Under the MR setup here, a new-product committee meets once a month to review marketing data, new designs, Value Analysis reports, and so forth. Sales, advertising, distribution, and manufacturing people review proposals. This sort of product research, coupled with research in methods improvement, pays off in cheaper production costs and more competitive sales patterns.

MR as process improvement

Manufacturing research at Boeing Airplane Co is primarily concerned with process improvement, Aero-Space Div's M L Schuehle told the meeting. Boeing uses production workers for MR work—carried out either in support shops, or sometimes on regular production lines.

Schuehle emphasized the importance of using production employees for research work. It gives shop people experience and training in processes that in a few years will come out of the research stage and into standard production. When the job is put into operation, shop people are trained for it.

MR as advanced research

In a company like Republic Aviation, manufacturing research must venture into far more exotic fields. Here MR must look, according to Republic's Paul Holmes, into "unorthodox fabrication techniques and exotic materials." Research concentrates on ways to overcome problems peculiar to the aircraft and missile industry. Conventional machining techniques, for example, often just don't work with exotic metals. Solution is to research new techniques—chipless machining, electron-beam welding, ultrasonic cutting, spark machining, and the like—which will pay off in future aero-space products.

Ten years may see the twilight of the unskilled worker, a casualty of . . .

Our changing labor force

The days of the unskilled, even the semi-skilled, worker are numbered. By the end of this decade, many workers who today perform routine functions on metalworking assembly lines will have fallen victim in large numbers to fast-advancing technology and mechanization.

This is not an idle prediction, but a forecast by the Department of Labor based on extensive surveys of changes that can be expected in the work patterns of American industry in the 1960s. And it is only one of several startling facts published in the Department of Labor's report on "Manpower: Challenge of the 1960s."

For instance, overall demand for workers will rise by 25% in the next 10 years, openings for professional and technical personnel will increase 41% during the same period, but demand for unskilled workers will drop if anything.

There will also be greater need for clerical and sales help 10 years from now, 27% more to be exact. But at the same time, 17% fewer farm workers will be needed.

There will be 13.5 million more job openings by 1970 than there are today. Who will fill them? For one thing, the Department of Labor looks for young people, ages 14 to 24, to fill about half of the increase. Something like 26-million young workers will enter the labor force in the 1960s—3 million in 1970 alone, compared with 2.1 million this year, and 1.8 million in 1950.

This means the United States will have a net increase of about 6.5-million workers in the 14-24 age group alone by 1970—just about half of the number of workers needed to fill the expected overall 13.5-million gain in jobs.

A gain of 2.5-million workers is also expected to be provided by the 14 to 19 age group by 1970, and a still further gain of 1.2 million from the 14-17 group. Another 4-million young workers are expected to come from the 20 to 24 year bracket.

But the key working-age group, 25 to 44 years old, will only increase 1.6 million in this decade. Actually, the 35-44 year age bracket will decrease by some 200,000 workers by 1970.

The 35-44 year group is especially important because it encompasses a large number of highly skilled workers, managers, and executives. It is startling to note that the Labor Department actually expects the number of male workers of this age to drop off 400,000, but that this will be partially offset by an increase of 200,000 women workers of the same age.

This brings up the crux of the Department's report: **Women will have to become a much larger source of labor. By 1970, one out of every three workers in the United States will be a woman.**

The Department has an explanation for this. Women are having to spend less and less time on household chores because of the development of home labor-saving devices, and packaged pre-cooked meals. This gives the housewife a chance to take a job to improve her family's standard of living. This is especially true of the housewife whose children reach school age and do not require all-day attention. She can then take a part or full time job in the trade and service industries in her own neighborhood—and there'll be a lot more such jobs available as time goes on.

What will all these drastic changes in the American labor force mean to industry? In essence, it means that time-established personnel policies must be thrown out the window and whole new concepts brought in. For instance:

- By 1970, there will be intense competition for supervisors and junior executives, ages 35 to 44. It is thus not too soon to begin scouting *now*, while competition isn't intensive, for employees who will assure a steady supply of qualified manpower over the next 10 years.
- It will be necessary to hire women for jobs they have never filled before.
- A firm must start *now* to attract and keep all the junior talent that is available, and special efforts will be needed to insure loyalty, so that a young worker's knowledge and experience will pay off for the company when he matures.

Summed up: For the next 10 years, skilled managers and technicians will be scarce. If a firm cannot lay in a supply now, it had better prepare for the intensive struggle which will surely come, or face disaster in the 1960-1970 decade.

Biggest radial drills go to work at GE

As many as 60 36-inch-long holes can now be drilled *vertically* in turbine shells weighing up to 50 tons at General Electric's Large Steam Turbine - Generator Department, Schenectady, NY. Twin 40-ton radial drills, said to be the country's biggest and most powerful (see cover) are equipped with 10-foot arms and up to 5-inch drills. The turbine shell material is 250 Bhn high-temperature, high-alloy steel.

The 50-hp Cincinnati-Bickford machines are designed for easy setup. Operator merely figures depth and width of the work, sets parallel blocks in line to accept the piece. Then a crane moves the shell in, lowers it onto the blocks, and the machine is ready for operation with only minor corrections in alignment.

The drills operate vertically, and because of their size (columns are 34 inches in diameter, 12 feet high) are comparatively chatter and vibration free—so that better alignment and finer tolerances can be maintained.

Back boring can also be done on the twin radials. After the drill has finished its travel, a boring bar is inserted in the hole, the spindle reverses its travel as the boring cutter enlarges the hole. This, GE has found, is cheaper than direct-drilling large holes.

Pushbutton pendant controls operate traverse to head and spindle, the driving clutch, hydraulic head and column clamps, and arm travel. Other controls: a power assist for moving the 10-foot arms, and a master stop switch.

Spindle is supported by seven angular-contact, antifriction bearings—four bearings taking vertical thrust, and the other three taking backfacing loads.

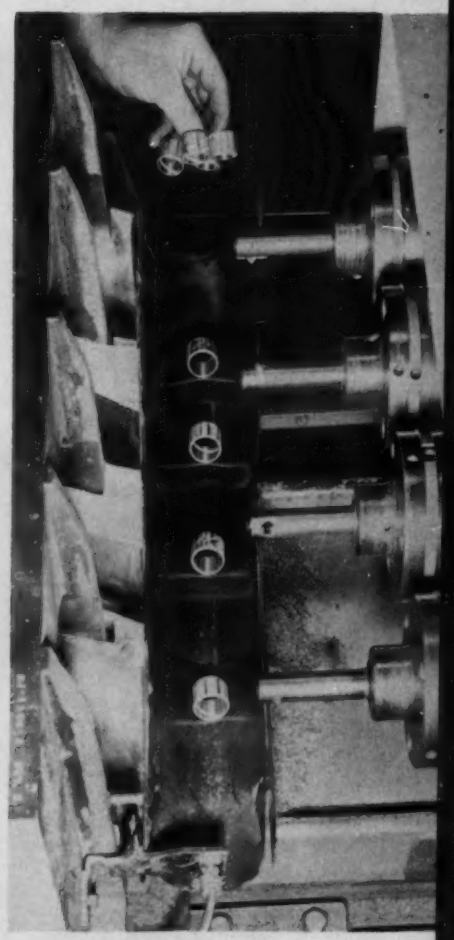
Diamonds cut costs for fast boring cycles

Boring machines at Federal-Mogul, Detroit, can finish formed bimetal bushings with either carbide or diamond tools—there is no difference in production rate or finish on the work. The reason single-point diamonds are installed is simply less tool changing, because the harder tools last longer and therefore cost less. One machine may produce up to 15,000 finished bushings per shift, so any machine stoppage is critical.

A typical job is a rolled split bushing for a tractor engine, made with a shell of SAE 1010, a sintered-bronze liner 0.020 in. thick, and a flash coat of tin to prevent rust on the steel back. The inside diameters are finish-machined on a four-spindle boring machine to 0.986 in. ±0.0005 in. The 1¼-in.-long bushing is bored to remove about 0.0008 in. of tin-coated sintered bronze in the ID. Cycle time is only 10 seconds.

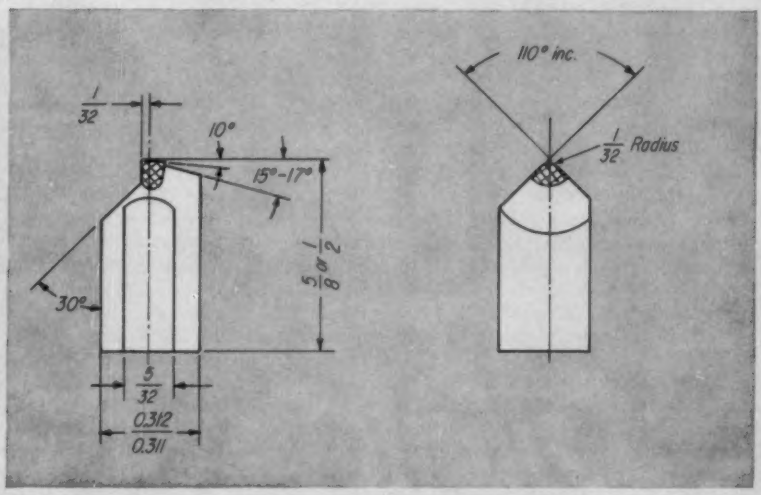
Because the cutting speed is fairly high and the machining time is so short, the operation is completed without coolant, which simplifies the process and adds to cleanliness and economy.

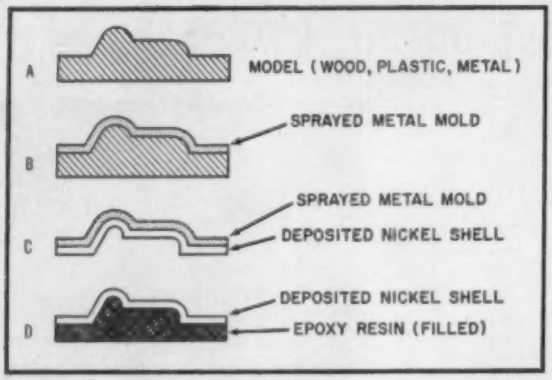
Bimetal bushings have steel shells with inserts of sintered bronze (Federaloy), tin, lead, or aluminum



Four-spindle Ex-Cell-O drops work to tilted trough that feeds parts to rear

Boring diamonds rotate at 3600 rpm, cut at 300 sfpm without coolant because cycle time is only 10 seconds. Dimensions (right) are typical





Carbonyl nickel shells are completed in four steps from the drawing, except for an extra step when the female counterpart of a male mold, or vice versa, is needed. Tin-alloy mold is made from master pattern, then this special mold is given deposit of nickel in chamber and nickel shell is stripped from mold

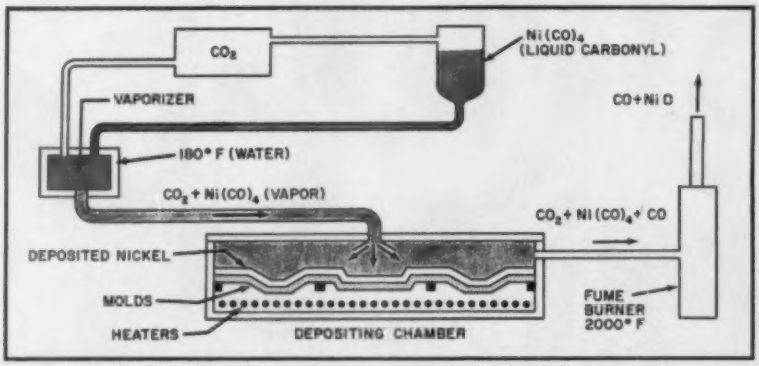
Nickel tooling includes injection, compression, and blow molds for plastics; sand-casting patterns; permanent molds for aluminum; forming and drawing dies. For functional rather than finishing applications, this process also can apply a conductive coating to plastic or produce an inexpensive ($20-$25/sq ft form of honeycomb

Nickel from gas builds dies and molds

Molds, tools, forming dies, patterns, fixtures and other three-dimensional shapes are given unique properties by a process licensed to Carbonyl Metal Products/The Budd Co, Conshohocken, Pa, by the Union Carbide and Carbon Co. In the process, which promises to be highly competitive with electroforming and some other electrolytic techniques, nickel carbonyl gas ($NI(CO)_4$) is decomposed by heat in a sealed chamber to yield high-purity metallic nickel plus carbon-monoxide gas. Because the nickel, as in other vapor-metallizing processes, is deposited in molecular form, it produces a very dense and detailed deposit on the surface of the heated mold in the chamber.

Four years of research aimed at production of better, and cheaper, forming dies for use in Budd's own metal-stamping operations, created the technique. It has a tremendous range of potential applications in metalworking, as well as in the rubber, plastics, and glass industries. Budd has an exclusive license in the transportation field and a non-exclusive license for all other applications.

Carbonyl-nickel tooling, in addition to the savings which result from eliminating machining, has unique advantages. Foundry patterns are tough (Brinell hardness, 181-222), and workharden under impact. The nickel melts at 2600 F. Its tensile strength is 85,000 to 95,000 psi and increases with cold working. Ductility is high (elongation-15 to 20%).



Carbonyl process starts with a tank of liquefied nickel-carbonyl gas. System and chamber are purged of air with CO_2 gas, then $NI(CO)_4$ is introduced. Tin-alloy mold in chamber is electrically heated to 325-340 F. Gas decomposes on contact with heated mold to deposit nickel on mold. CO is piped to burner. Nickel-carbonyl gas is about one-third nickel by weight; is extremely toxic

In addition, the nickel deposit has extremely high thermal shock properties up to 1600 F, permitting rapid cooling or quenching. It can be welded, patched, silver soldered or soft soldered without difficulty.

When used in drawing or forming dies, the carbonyl nickel has little or no adhesion to steel or similar metals, hence does not "cold-weld" on impact. Even under extreme conditions of draw and edge pressures, there is no danger of either pickup or scoring. Lubricants are rarely necessary because of the metal's natural anti-friction properties.

Patterns, dies, and permanent-molds are available from about 1 in. by 1 in. to 60 in. by 100 in. Current delivery is 4 to 6 weeks. There is no limit to the degree of complexity of shape or surface configuration. In fact, the more highly complicated the piece, the greater the saving as compared with conventional machining and hand-finishing methods. (Nickel-carbonyl-process patterns usually are not competitive with simple patterns — such as can be turned on a lathe.)

The nickel shell can be of any desired thickness. For most tools, it is 1/16 to ⅜-in. thick, backed with epoxy resin mixed with iron or aluminum fibers. Master pattern detail is duplicated with extreme accuracy. Reproducibility tolerances are from –0.005 to +0.010 in. overall, with an average tolerance of ±0.005 in.

Refractory fixtures aid brazing

Suppose you want to build fixtures for electric blanket brazing, is there any material better than graphite? North American Aviation thinks so after doing the job with two fused silica refractories, Masrock and Glasrock Foam, both made by Glasrock Corp, Atlanta.

Slip-castable Masrock, fired at 2000 F, has 20,000 psi modulus of rupture strength, plus a low coefficient of linear expansion. Glasrock Foam has low density, low linear expansion and thermal conductivity, comes in 4 x 18 x 18 in. blocks.

North American has found that graphite doesn't work too well as a construction material for fixtures for electric blanket brazing because it isn't stable enough to provide a basic reference plane, and it has a relatively high heat transfer rate.

Cast silica, as the central element of each electric blanket fixture, takes on the basic configuration of the component to be brazed. The foam serves as an outer rim, or retaining component.

Basically, the central element is made by casting and firing slip—in much the same way as conventional tableware is produced. Foam bricks are bound together around its edges with a slip cement containing silica sand. Fixtures so made resemble plaster of paris mockups, and have 4-inch-thick bases.

Easier fixture handling

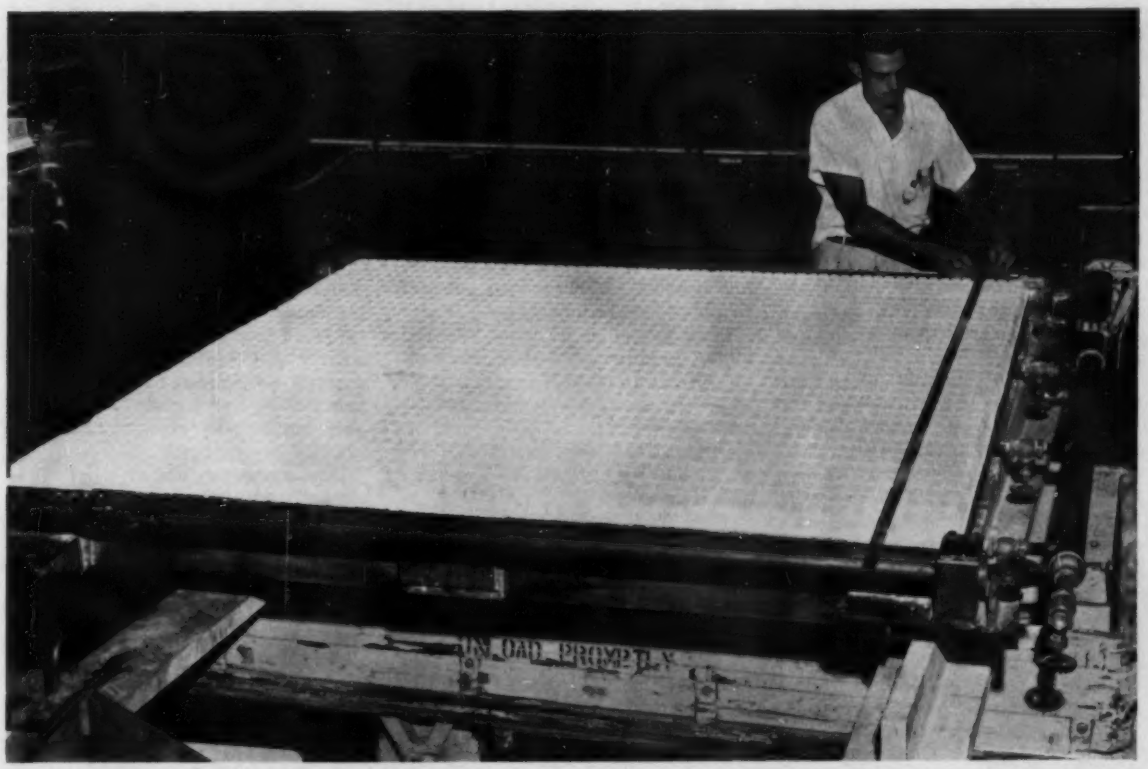
To make fixture handling easier, lift holes are drilled in the silica, and the foam is bolted to a metal pan. Machining is done with ceramic or carbide tools at slow speeds and feeds, with a water coolant.

The fixtures are used in single retorts, each of which has a copper temperature-gradient equalizer with grooves for circulation of air when fast cooling is necessary. The loaded retort is placed between two platens and is heated as electricity is passed through Inconel strips which are insulated with Refrasil cloth.

If severely contoured parts must be brazed, a sheetmetal diaphragm is positioned between the retort and an upper pressure chamber—so that rubber seals make the upper and lower chambers airtight. In this way, either positive or negative pressure can be used during the entire brazing cycle.

Because of its low thermal conductivity and related properties, the silica fixture component remains absolutely flat during each brazing cycle and is undamaged by thermal shock caused by extensive heating or rapid cooling.

Foam components have appreciably less mechanical strength than fused silica, because of their comparatively low densities, but they are impervious to thermal shock, too, and carry only light loads. For this reason, careful handling is all that is needed to assure long life.



Technician at North American Aviation checks brazing fixture made from Masrock and Glasrock Foam

Is standard tooling too inflexible?

By Harold D Rodenbaugh,
production engineer, Instrument Div,
Lear Inc, Grand Rapids, Mich

"A standard tool is any tool manufactured to the builder's standards, cataloged, stocked, and marketed. Any deviation from the original stated standards removes that tool from the 'standard category.'"

Perhaps if we start with this basic definition of standard and semi-standard tools we'll be a long way toward unraveling a knotty, costly and confusing purchasing problem—one which is becoming increasingly more complex in this day of precision instrument production for the aircraft and missile industries.

Let's get down to cases:

A customer recently ordered several standard tools from a distributor, knowing that each was a standard item stocked on the distributor or manufacturer's shelves, BUT he appended these specifications to the purchase order:

"Purchase per vendor design and build (1) one quick-change boring head, (2) one quick-change boring bar, 1-in.-dia by 2-in. long with quick change adapter for above boring head, (3) six calibrated boring toolbits for above boring bar, and (4) a quick-change adapter as sketched for above quick-change boring head.

"Part print, operation cards, parts making specifications to accompany this order. Vendor to supply tools ground to corrected angles to produce part per operation card and identified as shown per specification.

"Vendor to supply transparencies of detailed design of all tooling listed on this order, and assembly print of boring tool to show preset dimension of boring tool 0.002 in. under low limit of bore diameter to be produced."

The tooling arrived—minus prints or tracings, so that it could not be inspected and put to work.

The irate customer promptly called the distributor, who relayed the complaint to the manufacturer in a long-distance call.

"That tooling is standard, you don't need tracings," the manufacturer said. It turned out later that he was wrong.

It took four long-distance calls between the manufacturer and distributor, and a loss of five weeks to the customer before the tooling could be cleared through the customer's tool inspection and put into production. By then, the tracings had come through, but only two of the four tracings were detailed.

Why this time and money-consuming lack of understanding between customer and supplier?

Let's look first at what the customer, in this case a production engineer, had in mind when he insisted on deviations from standard off-the-shelf tooling.

First off, the tools were to be used as a unit to produce to a specific operation card.

Then the 1-inch-diameter bar had to be altered from the manufacturer's 6-inch standard length to 2 inches for this particular job.

Boring bits had to be able to cut aluminum, bore to hold 0.0003 in. tolerance, produce a square shoulder and hold a 0.010-in. corner radius.

At the customer's plant, the special-purpose boring tools were to be sharpened, preset in cutter grind, and stocked in a specific tool crib location. The tools were to be called out on operation card by the process engineering section, kitted, and delivered to the machine when called for—and they were expected to be set and to produce with a minimum of adjustment within a time set by standards.

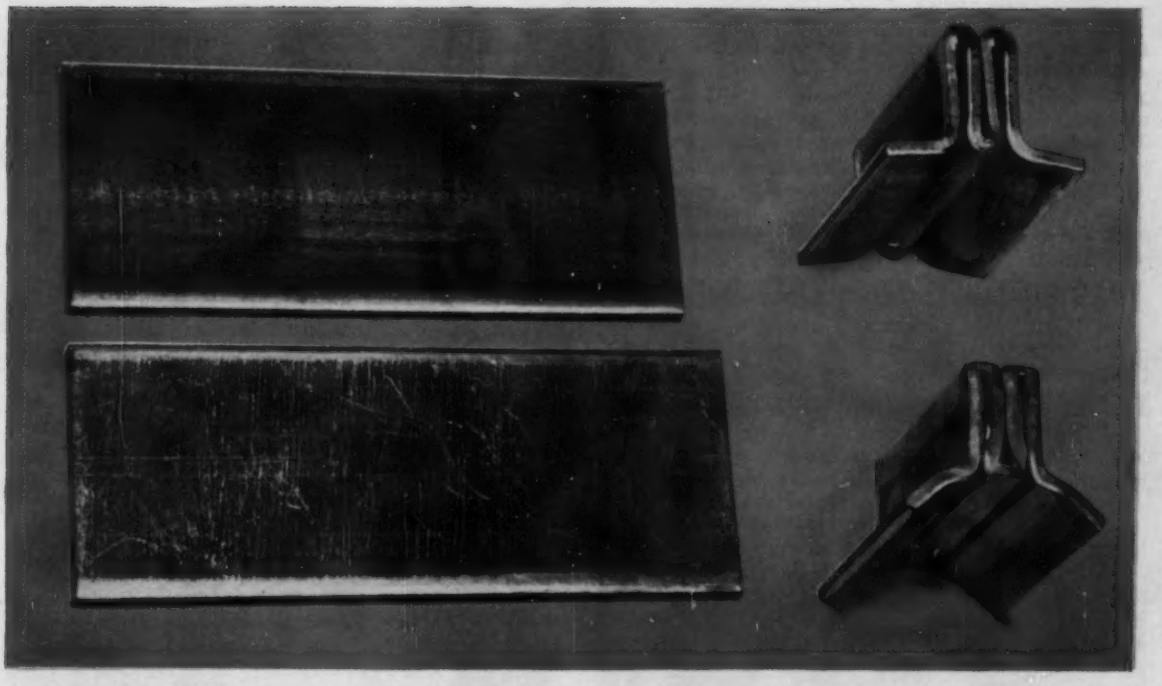
Not knowing all this, the supplier merely interpreted the order as one for standard tools stocked on his shelves—and because of this thinking-only-in-terms-of-standards, he failed to understand why detailed specifications accompanied the purchase order.

Thinking only in terms of standard on-the-shelf tools, the supplier quoted the regular catalog price, completely ignoring the cost of changing standard tools to special-purpose tools.

And there lies a basic difference in standard tool thinking between manufacturers and distributors and the customer. To the supplier, a standard tool is a standard tool even with minor variations. This viewpoint is not shared by high-production tooling men for obvious reasons, and that is why misunderstandings often arise in tool buying.

The customer knows that it is cheaper for him to buy standard tools altered to his requirements, than to rework the tools after they have been bought.

For this reason, it might be well for manufacturers of standard tooling to figure ways in which they can quickly, accurately and economically convert the almost-but-not-quite standard tool to the absolute specific tool that the high-production, high-precision industries of today demand.



1960 redesign winner: "Accordion pleating" makes pole piece

Wilbur F Carlson, superintendent, Manufacturing Facilities, Delco Appliance Div, General Motors Corp, Rochester, N Y

This pole piece for servo motors, formerly machined from bar stock, was redesigned as a "stacked stamping" to win the 1960 Higgins Redesign Award. Savings of 70% were achieved by the conversion. Strip stock of best electrical characteristics was used to eliminate scrap completely. The material has a thickness tolerance of ±0.008 in., and width tolerance of ±0.016 in.—a total volume variation of about 15% per unit of length. The part receives no machining, hence the correct volume of metal must be present in the blank, so that the pole piece will contain the right amount of metal. After-coining, dimensional accuracy is obtained by feeding the strip through rolls that measure thickness and width (information is transmitted to a variable stop at blanking) assuring constant volume within 1% by varying the blank length as much as 0.900 in. After cutoff, blank is fed through a die which accordion pleats it in a 100-ton OBI press. Coining operation follows in a 400-ton press, where wings are set to curvature and the center section flattened

Seven designs that have saved $2 million a year point up...

The case for stampings

By Carter C Higgins, president
Worcester Pressed Steel Co,
Worcester, Mass
and chairman, Westprest Inc, Amarillo, Texas

"If it can be stamped, you can bet that will be the cheapest way to make the part."

Too flat a statement, one which is easy to say but hard to prove? Perhaps, but it echoes the sincere belief of the entire metal stampings industry, which stands ready to cite case after case in which stamping has proved the most economical way to make a given part.

There is today a definite swing to stampings as more and more product designers and production men are finding that the cheapest way to make a precise, strong part is to stamp it from flat-rolled metal. Yet the surface has hardly been scratched—many more parts could easily be made originally as stampings, instead of starting out as castings, weldments, or molded plastics.

Understandably, many manufacturers are reluctant to break away from their traditional methods of manufacture and "take the step to stampings" simply because they do not realize the state to which the arts of die design and pressworking have advanced.

They find it difficult, for instance, to understand how their particular part can be stamped, how to overcome problems in die design and metal flow, how to plan secondary operations, and how to assemble the stamping with other components of a product.

Yet there are countless run-of-the mine conversions to stampings. Many of them, unfortunately took too long to bring into being. But every time a plant achieves savings of 20, 40 and even 70% in the manufacture of a part by stamping, the technique acquires new converts who will look for other applications where similar savings will be effected.

(Continued on next page)

The case for stampings . . .

To further the swing to stamping, the John Woodman Higgins Redesign Award was established five years ago. It is presented annually at the Spring Meeting of the Pressed Metal Institute for the best example of redesigning as a stamping a part that was previously made in another way. Originality of design and the dollar and percentage savings it effects are prime considerations in selecting a winner.

Since the Award's inception in 1955, it has been estimated that prize-winning entries shown on these pages have saved their originating companies upwards of $2 million per year in production costs. Award-winning redesigns from 1955 through 1960 (just presented on March 25) are analyzed and discussed in this article, as are two others that won honorable mentions.

These ingenious examples of conversions to stampings indicate that creativity in stamping design and tooling can solve what may seem almost insurmountable obstacles to those not familiar with the state of the art.

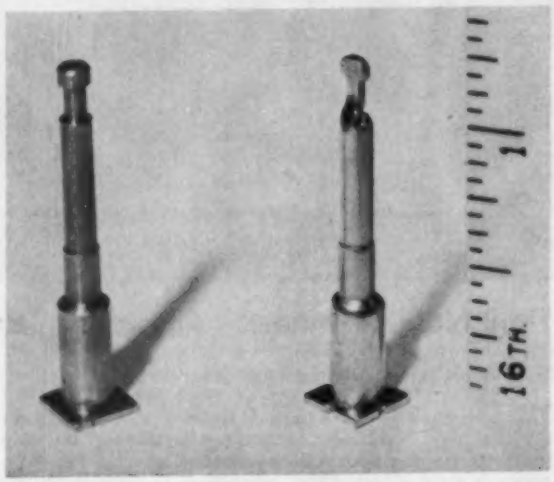
1959 winner—Holding pin terminals to close tolerances

Fred Faje, Matthew Sosnowski and Louis Klynas,
Malco Tool & Mfg Co

For lots of more than 50,000 pieces stamping engineers seek to design parts which can be made at least one for each stroke of the press—even though several operations are involved. This result was achieved by producing terminal pins in progressive dies—saving Malco $114,000 a year (about 41% of total cost) on these small 1¼-in.-long parts.

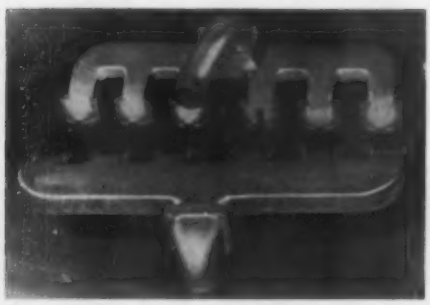
Experienced stampers will recognize the skill required to wrap the 0.035-in.-thick copper around and coin it, so that the seam will not leak solder. Tolerances are held to 0.003 in., the same as on the parts when they were machined. It took almost a year to develop the tool.

Copper turned out to be an excellent forming material. This saved an operation, because the parts had to be plated if made from ¼-in.-square brass rod. Ingenious, too, was replacing the machine pin with an 0.035 x 0.062-in. tang. Notice the notches in the upper flange, which eliminate stretching of the metal around the upper diameter.

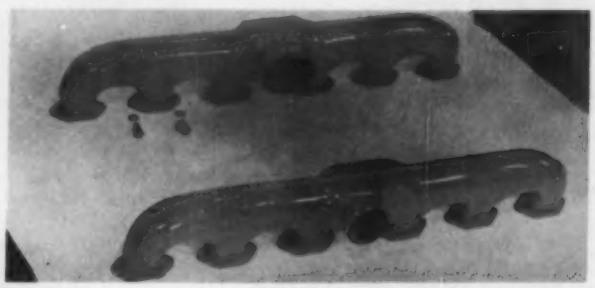


1958 winner—Truck manifold stamped in halves

Jack Greathouse, Mack Trucks Inc



OLD METHOD



NEW METHOD

Manifolds for heavy-duty engines are usually cast because of low-volume requirements. To save weight without a major cost penalty, Mack cast these manifolds in aluminum.

Winner Jack Greathouse remembered that stampings—sometimes ceramic coated—had replaced heavier parts in gas burners and combustion chambers. And he knew that stamped manifolds would solve several problems if die charges were not too high. By standardizing models, production was upped to 750 manifolds a month, so that savings equalled die costs in two months.

Costs were reduced by welding together two essentially similar halves. Advantages of the stamped manifold: (1) savings of 34% or $70,235 a year, (2) weight savings of 60% or 12 lb per assembly, (3) better air flow, matched expansion, easy welding repairs. Paint adheres much better to the stamped assembly than it did to the cast manifold.

1958 Honorable Mention–Stamped Hose couplings

C A Burnett, works manager, Scovill Mfg Co

Scovill had long made fittings for garden hose on screw machines, but it also had stamping equipment and eyelet machines. When Scovill swung over to stamped fittings, its ideas were widely copied for plastic hose.

The screw machined coupling fitted over the hose, was held in place by driving in a threaded plug (also made as a screw machine part). Problem was to design a less-costly sheet metal coupling with equivalent or greater holding power, even though it had to be reattachable.

Not only the nut, body and shank of the coupling are now made in presses (and roll-threaded), but the thread plug has been converted, too. Result: costs of making these hose sets have been halved.

1958 Honorable Mention—Stamping four housings

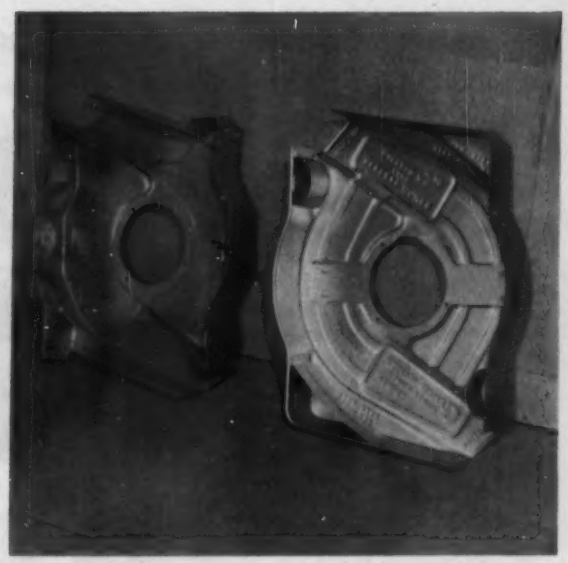
Arthur J Harsch, Morrison Steel Products Co

Four models of cast housing (decks) for power lawn mowers were redesigned to steel stampings to meet stiffening competition. Some 300,000 such decks are used by Morrison per year, at a saving of 35% over cast aluminum. Total savings: over $700,000.

Consumers, too, gained from the change to stampings: Danger of breakage from a sharp blow is eliminated, and weight is cut.

For an application of this kind, weight is inherently stronger and lighter than that of a casting. Additional strength is impaired by ribbing, without adding to parts cost. (Ribbing, incidentally, may add 40 to 50% greater resistance to flexing, allows use of lighter-gage material.)

Gussets and reinforcements have been added to the stampings, but basic stamping savings have more than absorbed the cost. Three strengthening plates and four gussets (to direct air and grass flow) are welded in place—the cheapest way, next to staking, of attaching stampings to each other. Stamping economy is promoted by setting tooling for decks side by side in a wide-bed press, thus saving handling between operations.



1957 winner–Dies form shower ball

Ernest J Urbas, Guaranty Specialty Mfg Co

This shower arm was originally made in two parts (photo, top). A ball end for the shower head was made on a screw machine and assembled onto a bent threaded tube. In new design (photo, bottom), the ball end is formed on the end of the tube in three press operations. Estimated annual savings: $25,000.

In the first press operation, the tube end is expanded, and the spherical radius of half the ball is formed. Bottoming of the punch nicks or bends the metal at the juncture of the radius and the tube wall. Second operation starts to close in the tube end (there is no interior support), and in the third operation the ball is rounded off as the weakened nicked section collapses inward to permit more swivel action of the shower head.

The case for stampings . . .

1956 winner—Wave-guide flange for TR radar tubes

Francis B Lord, Lord Machine Co

Some redesigns have to look like the original design, because function controls the design.

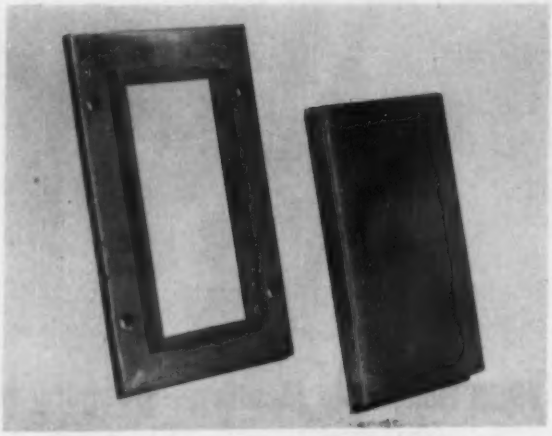
This wave-guide flange was originally machined complete in small quantities. Later, a forging was substituted, but partial machining and broaching were still required. Eventually, the stamper was given a chance to show what he could do.

The coined stamping required only a light grind on the back for flatness. Sheared edges were smoothed by being forced against the tools. Savings amounted to $74,000 a year.

To make the stamping, ¼-inch hot-rolled steel was annealed to remove embrittlement caused by piercing.

Next, the flange was squeezed under 800 tons pressure, forcing the metal to flow toward the higher center section.

Much tool development was necessary to get the metal to flow as high at the corners as at the edges.



1955 winner—Refrigerator backplate and drain trough

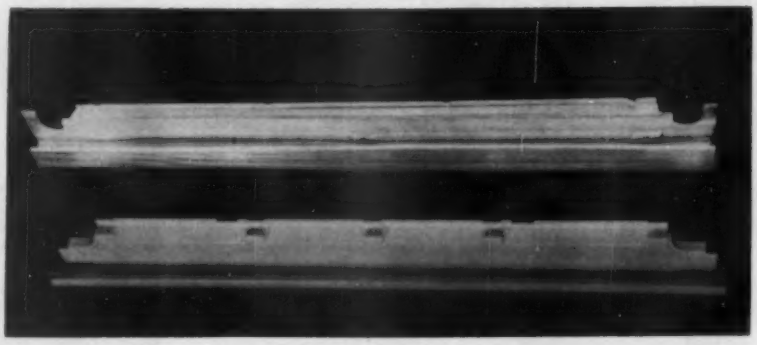
J B Horvay and D A Solley, General Electric Co

For the 1955 General Electric freezer, designers evolved the aluminum assembly shown at top in the accompanying photograph. It proved to be 23% cheaper than the bulky plastic drain trough (photo, bottom) used in earlier models.

Annual savings amounted to $45,000 when the improved assembly was purchased from a Long Island stamper.

A further advantage to GE: Defrost water ran off freely from the aluminum drain trough. Defrost water, on the other hand, froze to the old plastic drain trough, so that an electric heater had to be installed.

In redesigning the drain trough, Horvay and Solley simplified attachment: Three riveted clips replaced four locked-down clips.



Embossed ribs strengthen the stamping, and provide a surface less likely to show scratches. Because of pitching (for defrost drainoff) the blank is 5⅞ inches wide at the low end and 4⅝ inches at the upper end. Embossed lines on the front and back are not parallel in the blank, instead are lined up after folding.

About the John Woodman Higgins Redesign Award...

The John Woodman Higgins Redesign Award was first given in 1955 by Worcester Pressed Steel Co, Worcester, Mass, in honor of its chairman. It has since been presented annually at the Spring Technical Meeting of the Pressed Metal Institute. The contest is open to anyone, and the award is made annually on the basis of originality in design, and upon the dollar and percentage savings it has effected. The entry must deal with a part that was previously made in another way but is now successfully stamped. Judges are members of the Pressed Metal Awards Committee, headed by author Carter C Higgins.

Other members: Herbert Harig (representing the National Tool and Die Manufacturers' Association), Francis Sehn, representing the American Society of Tool & Manufacturing Engineers; E A Irwin, president of the Almo Co; Harold Daschner, managing director of the Pressed Metal Institute; Allen Grey of *Metal Progress*, Rupert LeGrand of AMERICAN MACHINIST/METALWORKING MANUFACTURING; PMI President Fred Rimmler, Volkert Stampings Inc, and Norman L Dunlap of Minster Machine Co.

This committee also judges the Presteel Award "for outstanding contribution to enlarging the field of metal stampings." Entries or recommendations should be submitted to PMI, 3673 Lee Road, Cleveland.

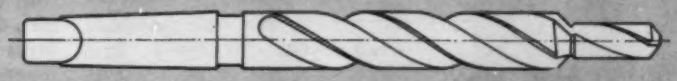
What *is* a subland tool?

Basically, it is a rotating tool for cutting two or more diameters in a single pass. It may be a drill, a reamer, a counterbore, an end mill, or a spotfacer—or it may be a combination of these cutting tools on a single tool body so that you can drill and ream, drill and counterbore, or drill and spotface in one pass.

With a subland tool, you can cut stepped holes like

this **this** **or even this**

A subland tool differs from an ordinary step drill (also a multiple-diameter tool) such as this



. . . because it is two or more different-diameter rotary cutting tools on a single body, with each drill (or reamer, or counterbore, etc.) retaining its own characteristics

Flutes (one for each diameter) extend back to the shank—so that chips do not pack as readily as with an ordinary step tool, and the end result is a clean, square face

A production man's guide to

SUBLAND TOOLS

By William Hofbauer
Vice president and general manager
Mohawk Tools, Inc
Montpelier, Ohio

In a transfer machine layout, 16 spindles and 16 subland drill-chamfer tools replaced 16 heads. The tools cost $6 apiece, the heads about $10,000 apiece. Net savings: $159,904. Cost reductions are seldom that spectacular, of course, but even the smallest shop can cut costs per hole with sublands, and reduce direct and indirect labor expenses. Here's why . . .

American Machinist / *Metalworking Manufacturing*

Special Report No. 487 · April 18, 1960

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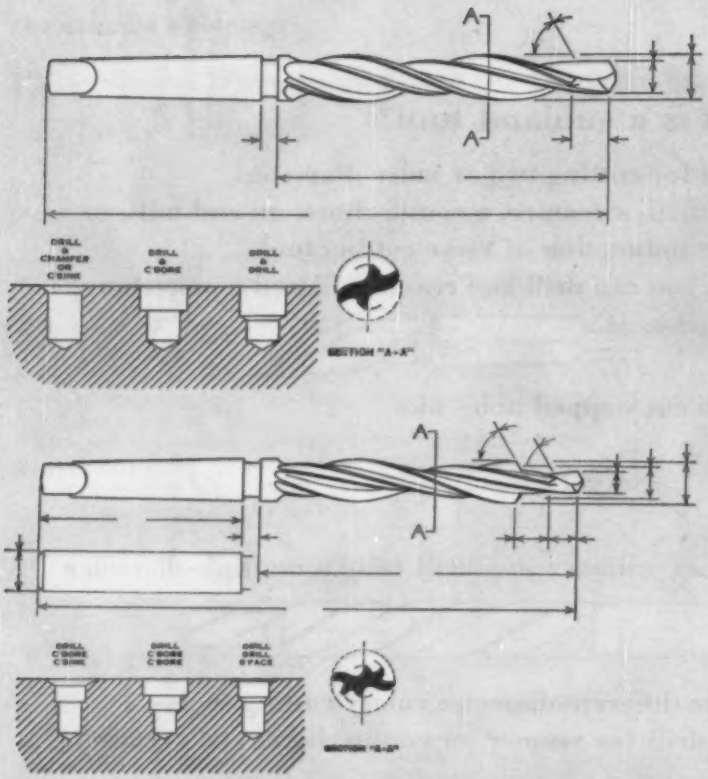
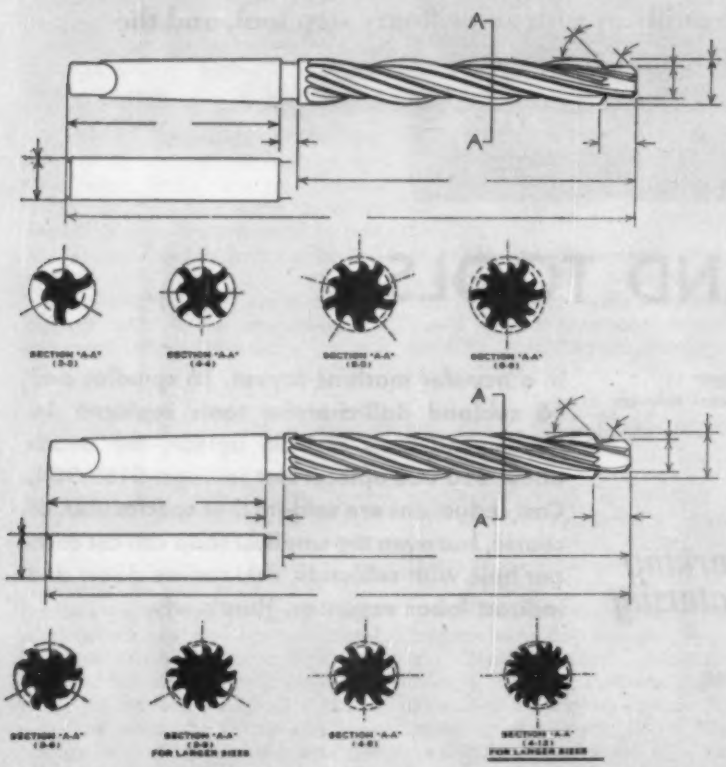


Subland drills of two diameters can combine drilling with chamfering or countersinking, drilling with counterboring, or the drilling of two holes. With three diameters, a subland can drill, counterbore, and countersink; drill and produce two counterbores, or drill two holes and spotface



Subland core drills or reamers have varying numbers of flutes to suit different conditions. This two-diameter tool can be made with three flutes on each diameter, or with four, five, or even six

Just one pass with a subland tool can perform a variety of rotary cutting operations. For instance, you can drill and ream, drill and countersink, or drill and chamfer with a single tool in a single pass. A hole with a dozen steps of varying diameters has been made in one pass, but that is believed to be a record. Two diameter holes are the rule, three and four diameters are fairly common.

To further explain subland tools, as described in the illustration on Page 1 of this report, the simplest subland is a drill with two lands on one diameter, and two lands on a different diameter. Both sets of lands (surfaces between grooves on the drill) extend the full flute length of the tool.

In effect, a subland drill may be considered as two conventional twist drills of different diameters combined into one tool that retains the same characteristics as the individual drills. Such construction provides a high-degree of built-in concentricity, because subland diameters are ground together between centers when the tool is made. Individual tools, on the contrary, depend for concentricity upon accurate indexing at the setup and upon rigidity, fixturing, and bushings.

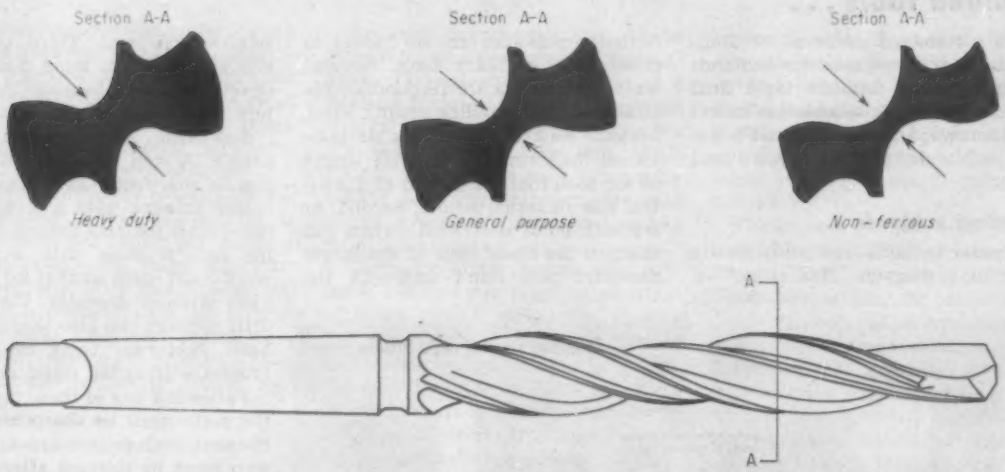
But let us establish one fact—a subland tool is not necessarily a drill. It can be a reamer, counterbore, end mill, countersink, spotfacer, core drill, or a combination of such rotary cutters—particularly useful in modern high-production setups.

Advantages of sublands

Obviously, subland tools are more complex than ordinary multiple-diameter step tools. How do they differ, and what advantages do they offer?

The chief difference between step tools and sublands is this: The subland tool's lands extend back the full flute length to the shank, so that chips are less inclined to pile up in the hole.

Because a step tool does not have separate flutes for each diameter, it must be ground on diameters as it wears. For instance, when it is sharpened on the larger diameter, the smaller one is nicked and eventually destroyed. This isn't quite as much of a problem when the step tool has a relatively long small diameter (long step) as it is when the step is short. Short steps permit only one or two regrinds, depending on the actual step length, before the small diameter is completely gone.



Carefully designed sublands differ in geometry for different applications. Web thickness, for example varies for heavy duty, general purpose, and nonferrous applications

The only recourse then is to cut off the tool behind the original small diameter and regrind a new one.

With a subland, however, length of step makes no difference in resharpening. In fact, the shorter the length of the small diameter, the cheaper the resharpening.

Because a subland is never sharpened on diameters—merely reground at the ends of the blades, original diameters and concentricity are held for the full life of the tool. And because each diameter has its own flutes, spiral, clearance and rake, cutting action is free and chips aren't a problem. A subland's overlapping blades eliminate burrs, too, producing clean, square faces.

Subland geometry

Surface speeds of each subland diameter vary. For this reason, there should not be too great a difference between the smallest and largest diameters on any given tool. A good rule of thumb: the small diameter should never be less than half the size of the larger one. Another general rule: length of the small diameter may not exceed three times its diameter, because the bushing will lack support if it is too far from the small diameter. For best results, a 2 to 1 ratio is preferred, while a 3 to 1 ratio is considered safe (this is the usual ratio for automated setups).

Web thickness must of necessity be a compromise among the individual optimum web thicknesses of the various diameters on the tool.

This standard web thickness for each diameter, incidentally, is a basis for the tool's original design, during which the designer evolves a web thickness that best suits all diameters. A web thin enough for effective cutting at the small diameter of a two-diameter tool, for example, could not support the larger diameter. For this reason, a compromise diameter must be reached which will suit both large and small diameters.

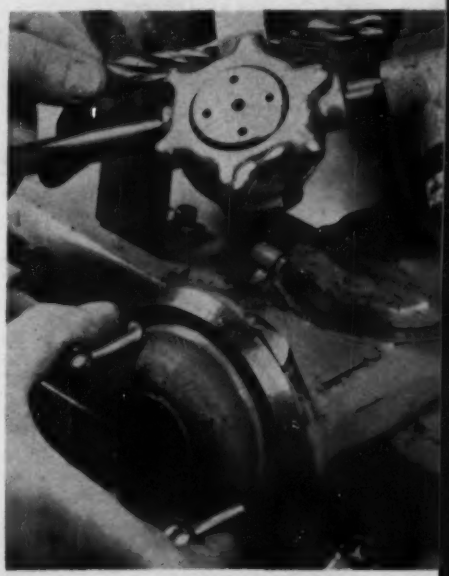
"Standard" sublands

Sublands are usually considered special tools, but standard types and sizes are commercially available. These tools are not only readily available, but are less expensive than made-to-order tools, and they can meet any reasonable dimensional requirements.

Fluted and heat-treated mass-produced blanks are available commercially with shanks ground and flutes polished. Tools in this condition are 75% complete, need only finish grinding to specifications before shipment., For example, a ½-in. nominal-size drill blank has a large-diameter range from 0.475 to 0.505 in., and a minimum small diameter of 0.265 in. Thus the smaller diameter can vary from a low limit of 0.265 in. up to the large diameter of 0.505, depending upon customer needs.

Drill-reamers can also be supplied from stocks of premachined standard hardened blanks. For instance, a taper shank subland drill-reamer (½-in. nominal size) has a reamer diameter ranging from 0.475 to 0.505 in., and a minimum drill diameter of 0.457 in. These stock tools have two drill flutes and four reamer flutes.

Unlike made-to-order subland tools, such "size optional" sublands are general-purpose cutting tools.



Grinding sublands isn't difficult: a two-diameter tool, for example, can be resharpened in a standard drill grinder in about the same time as it takes to sharpen two conventional tools. Because most sublands are made with a center hole at the shank end, a standard center stop provides axial location

But because they are made to suit a wide range of applications, their drill webs must be thinned after each resharpening to about 10% of the diameter. Such off-the-shelf drills and drill-reamers are stocked in all sizes and in standard jobbers lengths, as well as screw machine lengths.

Other standard sublands are designed for standard tap drill and chamfer sizes, and for straight and tapered dry-seal pipe taps. Available,

Subland tools . . .

too, are standard sublands for Heli-Coil taps; drill and chamfer sublands for non-cutting fluteless taps; drill and counterbore sublands for socket head screws; and tap drill and body-size sublands for all screws and studs.

Grinding sublands

Popular belief is that sublands are hard to resharpen. This is not so. Actually, sublands are no harder to grind than ordinary tools. Several built-in elements are responsible for attaining good grinding results. First, because each diameter has its individual flute running the full length of the tool, there is no loss of diametral size in resharpening. Second, no fracture point is created (when you sharpen the blade edge of the larger diameter you don't undercut the smaller diameter). Third, concentricity of the two or more diameters is never disturbed, because the diameters themselves are not ground.

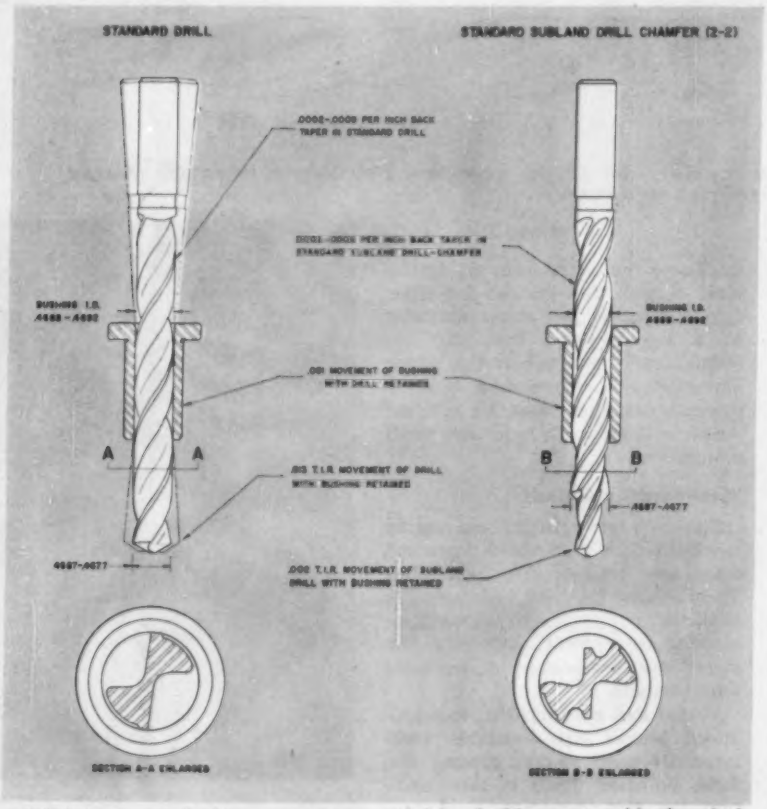
Subland sharpening is fairly simple. A step (smallest diameter) can be sharpened on a conventional cutter grinder with a V block and rear-center locating fixture. Or grinding can be done with a standard work head, such as that for grinding tools without a center. Commercial drill pointers can also sharpen many basic sublands. Tools can also be ground with radial relief grinders.

Following any of these procedures, the point must be sharpened with a conventional drill pointer, and the web must be thinned after each resharpening to about 10% of the diameter. Exceptions are those sublands specifically designed to eliminate web thinning.

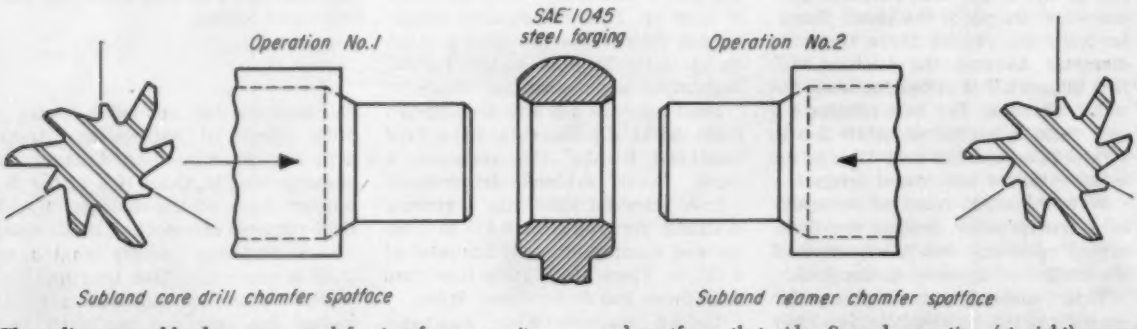
For instance, if you grind with a Sellers 1-G, the subland is located axially by a standard stop which engages a center in the shank while two synchronized jaws engage the front end near the large-diameter cutting edges.

As the tool is moved into grinding position, and as the operator oscillates it for radial clearance, the micrometer slide is fed in sufficiently to resharpen that side. The tool is then removed and indexed 180 degrees, so that the opposite side feeds into contact with the wheel. When micrometer readings for both sides are the same, sharpening is complete. Only thing the operator has to watch is feeding the tool too far into the wheel when he starts the second side.

Sharpening position for the large diameter of a tool below the margins of the small diameter can easily be determined with the simple-to-adjust positioning screw on the Sellers grinder. With this adjustment, both diameters can be sharpened easily.



A 200% increase in bushing support is provided by double-margin sublands, which keep four lands in contact with the bushing, instead of the usual two. As a result, tool and bushing wear is reduced, there is less wear at the spindle, holes are sized and located more accurately



Three-diameter sublands enter a steel forging from opposite sides, eliminating a number of conventional operations. First operation (at left): core drills the through hole and chamfers and spotfaces that side. Second operation (at right) reams the hole and chamfers and spotfaces it. All three diameters on each tool have three flutes

Occasionally, however, when the difference between the two diameters is great, standard jaw ends won't clear the large diameter so that the small diameter can be held for drill pointing. In this case, special jaws with greater clearance must be used.

A universal fixture is available for sublands over 1 inch in diameter. It has an outboard center for locating the tool axially, and finger for locating it radially. With this attachment, the tool is clamped in a vee to provide positive axial and radial location. The operator can remove a tool, check it, and replace it without losing location.

When to use sublands

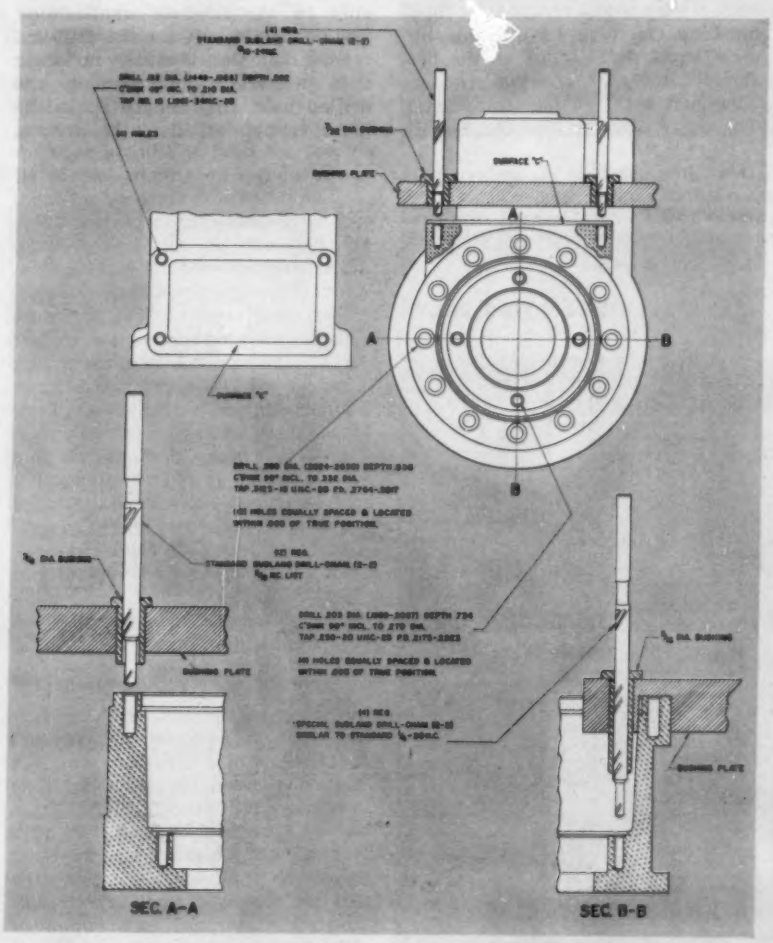
Most common use for sublands is in machining of two or more diameters with one tool in one pass—when maximum concentricity and tool life are prime requirements.

Economy is important, too, in determining whether or not to use sublands, because the initial cost of a subland is almost always higher than that of a conventional step tool. *But it's the cost per hole that really counts*, and you can only figure it by taking into account tool life and pieces produced per grind, along with initial costs.

There are other reasons why sublands cut cost per hole: elimination of extra passes makes for shorter cycle time, cuts out high-cost manual operations in low-volume or short-run operations, eliminates shuttling of work from spindle to spindle or indexing a turret. Bushings needn't be changed between passes.

And because fewer separate tools are needed for a job, perishable tool costs are reduced. So are indirect labor costs, because there are fewer tools to sharpen, and setups are easier to make. Jig and fixture costs are cut because there is no need for several different bushings (one to guide each single-diameter tool). Finally, because concentricity is more accurate, holes are easier to locate and depth can be better controlled.

These savings are multiplied in high-volume production, automated setups. Here, separate spindles and heads, or machines for each required diameter, can be eliminated. This alone can add up to thousands of dollars savings in capital investment on a transfer line. In an actual transfer machine layout, which called for separates heads to drill and chamfer holes before tapping, it was found that 16 spindles and 16 subland drill-chamfer tools could replace 16 heads. Tools cost $6 apiece, $96 in all. Heads cost around $10,000 each—$160,000 for 16 of them. A saving of $159,904 can buy a lot of sublands!



Typical subland tooling setup for drilling and chamfering 20 holes in three different surfaces of a sand-cast aluminum motor housing. Sublands are standard tap drill sizes combined with a chamfering section. Of the 20, only four have longer-than-average overall length, so that they can reach the recessed holes at B-B

Special sublands

Multi-margin subland drills can prevent drifting if holes are deeper than usual and if straightness is essential. This is done with four lands (or six, depending upon the size of the tool) piloting in the drill bushing, compared with two lands on most sublands.

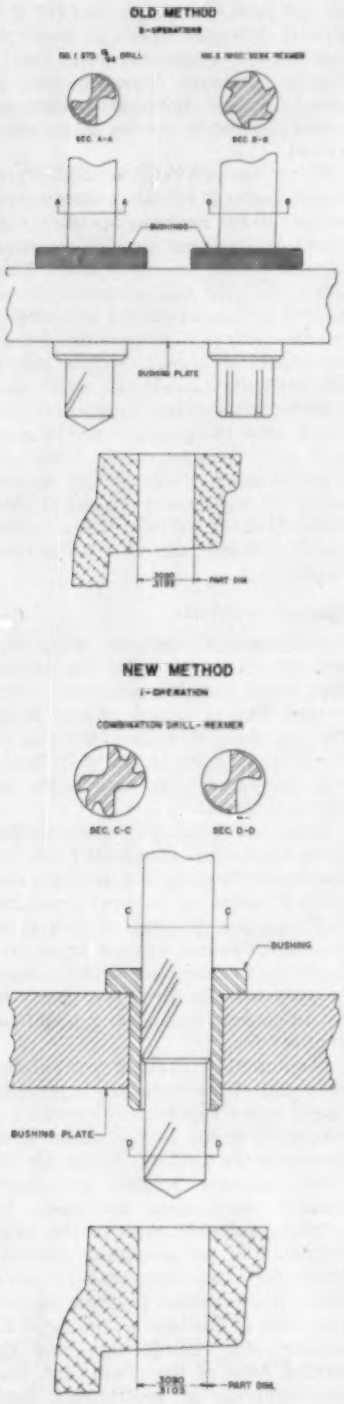
These multi-margin tools, unlike those tools with extra-wide lands for maximum bearing contact, achieve needed support without creating heat, galling, seizing, or marginal pickup. Of course, multi-margin sublands can't replace gun drills in really deep hole drilling, but they are worth considering in some deep hole applications.

Combination subland drill-chamfer-counterbore tools are especially useful when counterbore depths are minimum depth. Drill-chamfer-spotface tools are similarly advantageous when spotface heights are short. Usually, such tools are made by grinding a double angle on the large diameter, or by providing separate flutes for each function. In some cases, it is practical to grind the cutting edge of one land of the large diameter (for chamfering), and the cutting edge of the other land (for counterboring or spotfacing). Such tools are easy to maintain.

Subland end mill-chamfering tools are used in pairs, one in each of two opposed heads. These sublands make quick work of such operations as milling and chamfering drift slots in drill sockets and similar parts.

During machining, one tool feeds

Subland tools . . .



One operation replaces two in this drilling and reaming setup for cast aluminum blower plates used in diesel engine superchargers. The subland drill has two flutes—the reamer section six. Not only does this subland setup eliminate an operation, it eliminates need for a special reamer, and requires only one bushing

into the part to a depth slightly past center, then traverses along the axis of the slot to be produced—machining half of it and chamfering it at the same time.

The second tool, on the opposite side, is cycled slightly behind the first, and follows the same pattern. Because both cuts overlap inside the slot, the result is a clean elongated hole with both sides chamfered.

Taper rougher reamer

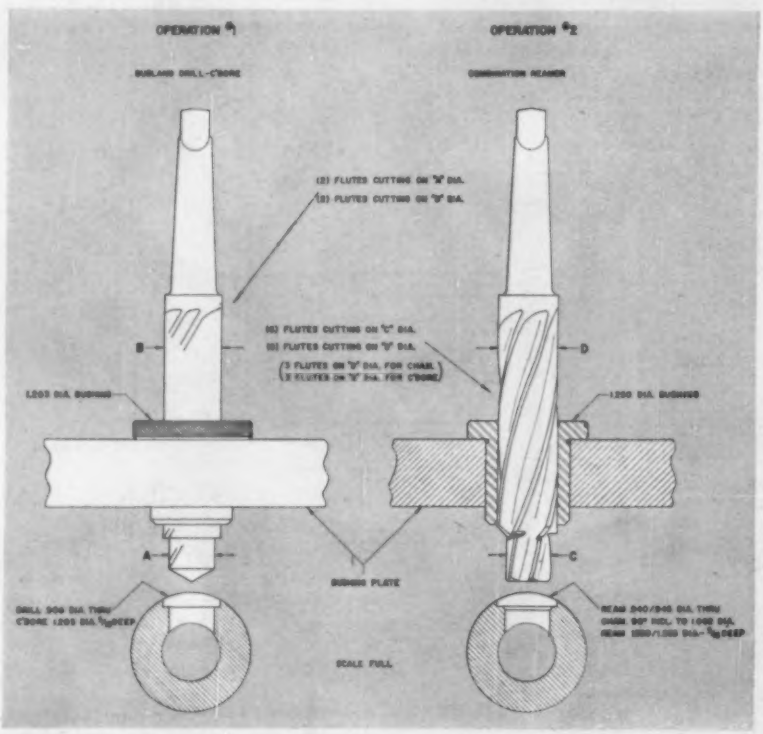
The subland taper rougher reamer develops considerably less cutting torque than ordinary taper roughers because it does end cutting instead of cutting on the entire taper diameter. Subland taper rougher reamers rough taper-cored holes, and must be followed with finish tapering tools.

These sublands generally consist of gradually widening diameters that produce a stepped hole from which little stock need be removed by taper finishing. One type, for example, has eight equal flutes—four on the first (small) diameter, of which two are combined with the fourth diameter. The other two flutes on the first diameter are combined with two flutes of the fifth diameter (step). Diameters two and six are combined with a set of two flutes, as are diameters three and seven. The end result: four cutting edges for the first diameter, and two for all others.

In one application, a rougher with four diameters (0.758, 0.797, 0.836, and 0.875 in.) replaced a 49/64 drill in roughing a hole to be finish taper reamed. Because the part was a steel forging, the straight drill left far too much stock to be removed by the finishing tool. With the taper-rougher, the cavity was roughed out more completely, greatly reducing the chip load on the finisher, and producing a superior finish.

Drill-reamers

Subland drill-reamers are far from "special," but there are some general rules to follow in using them. These tools drill and ream in one pass, but only in through-hole applications. The difference between the drill and reamer diameters is usually no larger than necessary for reaming the drilled hole. Drill length should be great enough to allow the drill to



Two subland tools rough drill, counterbore and ream this hydraulic steering gear piston made of steel tubing. Tool at left drills and counterbores the part, is followed by a combination tool which finish reams the through hole and the counterbore, then chamfers the intersection of the two holes

break through the part before the reamer engages it. Thickness of material should not exceed 1½ times the reamer diameter. The amount of stock left for reaming should be about 5% of the drill diameter, depending upon the material and use.

Although most subland drill-reamers will hold tolerances as close as 0.002 in., this limit may sometimes be tightened to 0.001 in. with good bushing support and accurate spindles. Cast iron, soft steel, and nonferrous materials have been worked successfully with these tools, as have forgings and even tough, hard steels, by providing sufficient back clearance for the reamer cutting lips.

Working without bushings

Sublands can be set up in three basic ways. Best-known and most accurate method (insofar as hole location and concentricity are concerned) involves guiding the tool into the work with bushings.

But recently it has been found that working without bushings lowers tool cost and increases tool life. Precautions are necessary, however. For instance, you can use a collet in the machine spindle to hold the tool on its shank—relying on spindle alignment for accurate hole location.

While this is accurate, it is not quite so precise as the bushing method, but it does eliminate bushings and bushing plates, and it eliminates the spindle wear that results from misalignment between spindles and bushings. Of course, sturdy spindles are necessary, but by holding the solid part of the tool shank a high degree of rigidity is achieved and, consequently, good tool life.

Tools used this way almost always have to be special, because flute lengths should be equal to hole depth —plus a length of about three diameters to allow for resharpening. One advantage in making these tools special: flutes and spirals can be tailored to a specific application.

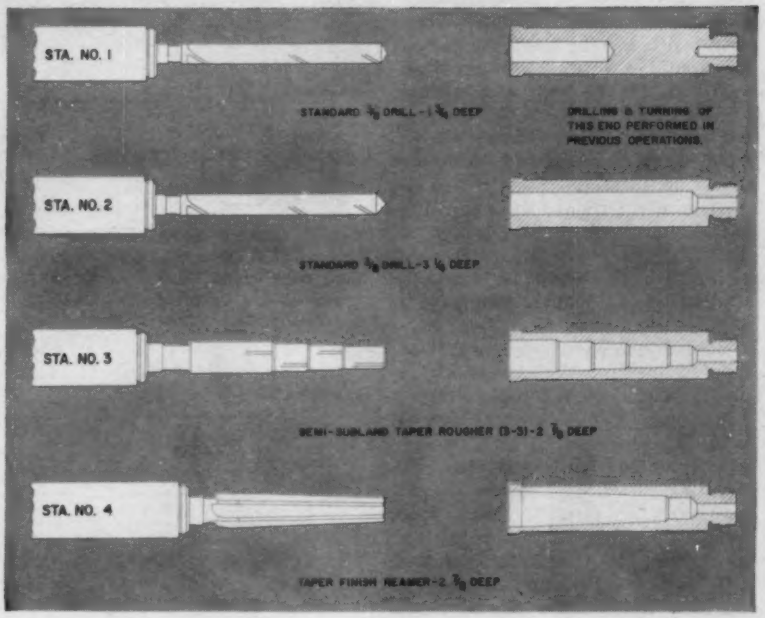
Alternate no-bushings method

A second no-bushings setup method also employs a collet, but this time the tool is held on the lands end, and wherever possible double-margin tools are used for maximum support. Measuring of tool life in holes per grind does not work as well with this technique as it does with the other method. Nevertheless, this technique does improve resharpening life greatly, and standard tools can be used so that this is by far the most economical method.

In working without bushings, it is essential to avoid using short-grip

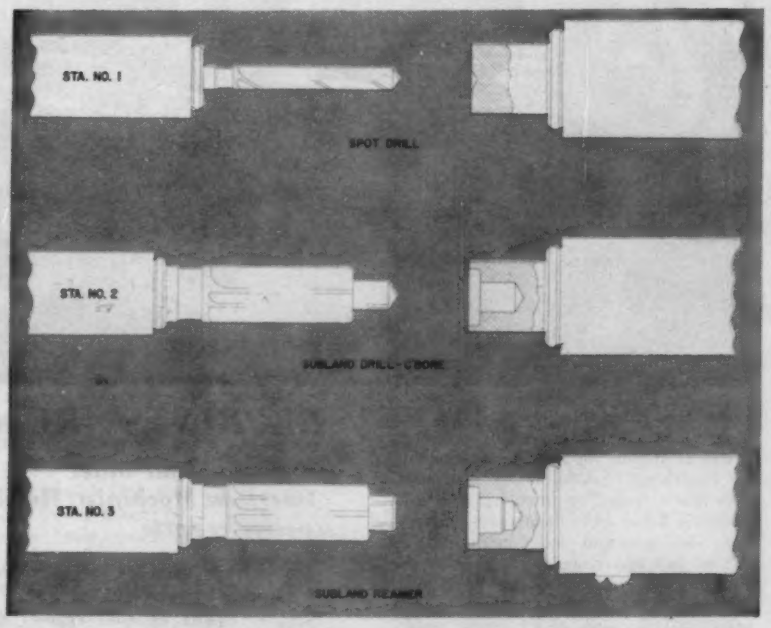
SUBLANDS IN SCREW MACHINING . . .

Plastics . . .


STA. NO. 1
STANDARD ⅜ DRILL - 1 ¾ DEEP
DRILLING & TURNING OF THIS END PERFORMED IN PREVIOUS OPERATIONS.
STA. NO. 2
STANDARD ⅜ DRILL - 3 ⅛ DEEP
STA. NO. 3
SEMI-SUBLAND TAPER ROUGHER (3-3)-2 ⅞ DEEP
STA. NO. 4
TAPER FINISH REAMER-2 ⅞ DEEP

Plastic valves are machined with sublands in this automatic screw machine setup this way: Conventional drills start the work in Stations 1 and 2, after which a subland taper rougher prepares the hole for finish taper reaming. A subland drill and counterbore produces a port hole as a secondary operation

Brass valve seats . . .



In another screw machine setup, sublands follow spot drilling to produce brass valve seats. The two diameters of the subland drill-counterbore each have two flutes; diameters of the reamer for finishing these holes each have three

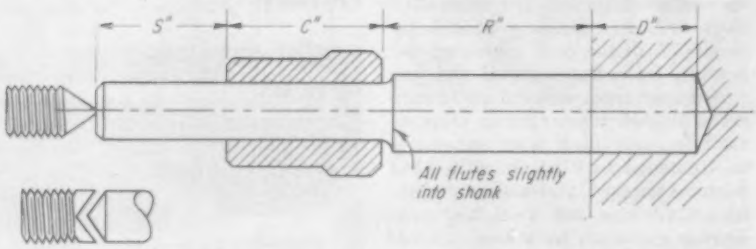
collets (those that do not provide a holding length equal to at least two diameters). Such short-grip collets cause slipping, chatter, and inaccuracy. Also to be avoided are split-sleeve, taper-shank drivers, which do not provide the needed axial adjustment for working without bushings. To achieve any resharpening life at all with these tools, the subland would have to extend too far from the holder, and accuracy would be lost.

Generally, then, the working-without-bushings technique depends largely upon individual requirements, which should be carefully studied before such a technique is used.

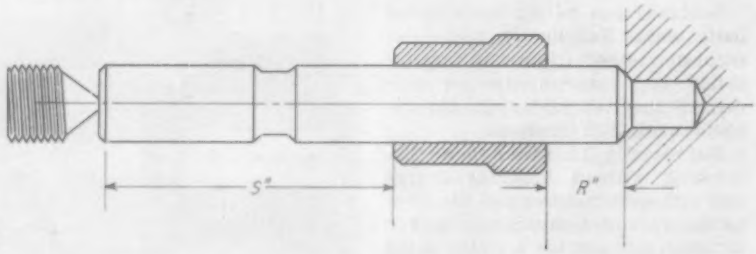
Subland tools are by no means confined to low-volume production. Actually, their time and money saving qualities multiply as production volume increases. For example, engine lines for two of the new US compact cars are set up with sublands, as are truck engine lines, automotive transmission lines, and machines for making tractor parts.

They are especially adaptable to transfer lines—extra heads, tooled up with identical sublands, keep production going while tools are being changed in the working heads.

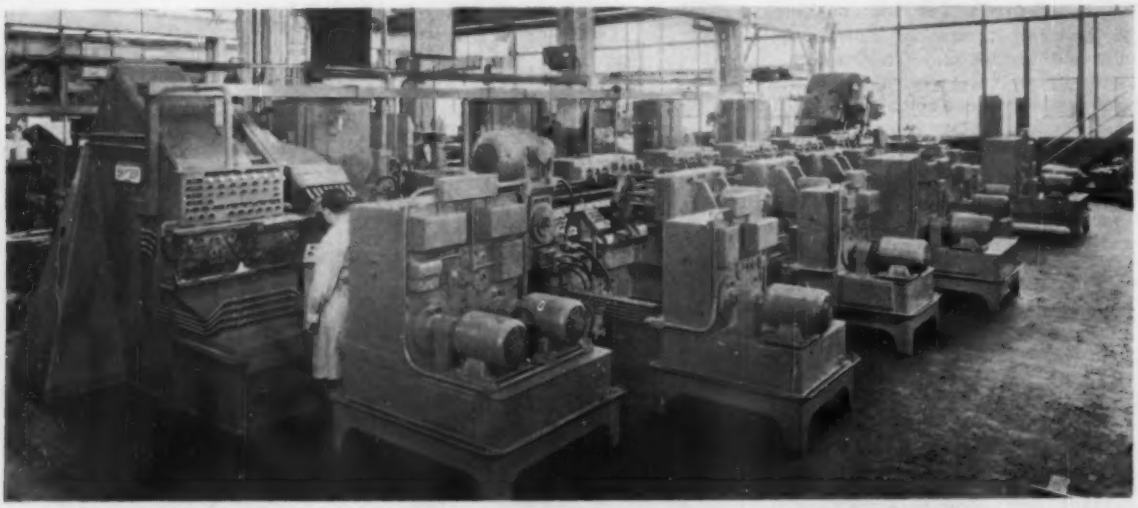
Two ways of drilling without bushings...



Drilling without bushings requires specific proportions in subland tools: depth of hole (drill penetration into the part D), plus a length (R) for resharpening equals total flute length. Shank length must be equal to collet length C plus R. Collet length should equal about two diameters. When it grips along its entire length, no driving flat or tang is needed



Another method of working without bushings involves a collet that holds the subland on flute lands. Resharpening allowance (R) in this case is kept as short as possible—about one-half of diameter. Double-margin tools are best for this kind of setup



Prime example of these subland tools in a highly automated, high-production setup is this 21-station Snyder transfer machine for machining Chrysler intake manifolds. This line is tooled up in such a way that sublands avoid extra heads. At one station, for example, combination drills (27/64 in.) and reamers (7/16 in.) perform two operations in one pass. Sublands are also used in a Snyder setup for machining the ends of Chevrolet crankshafts, and sublands eliminate extra heads in a Natco special that machines chrome-moly steel

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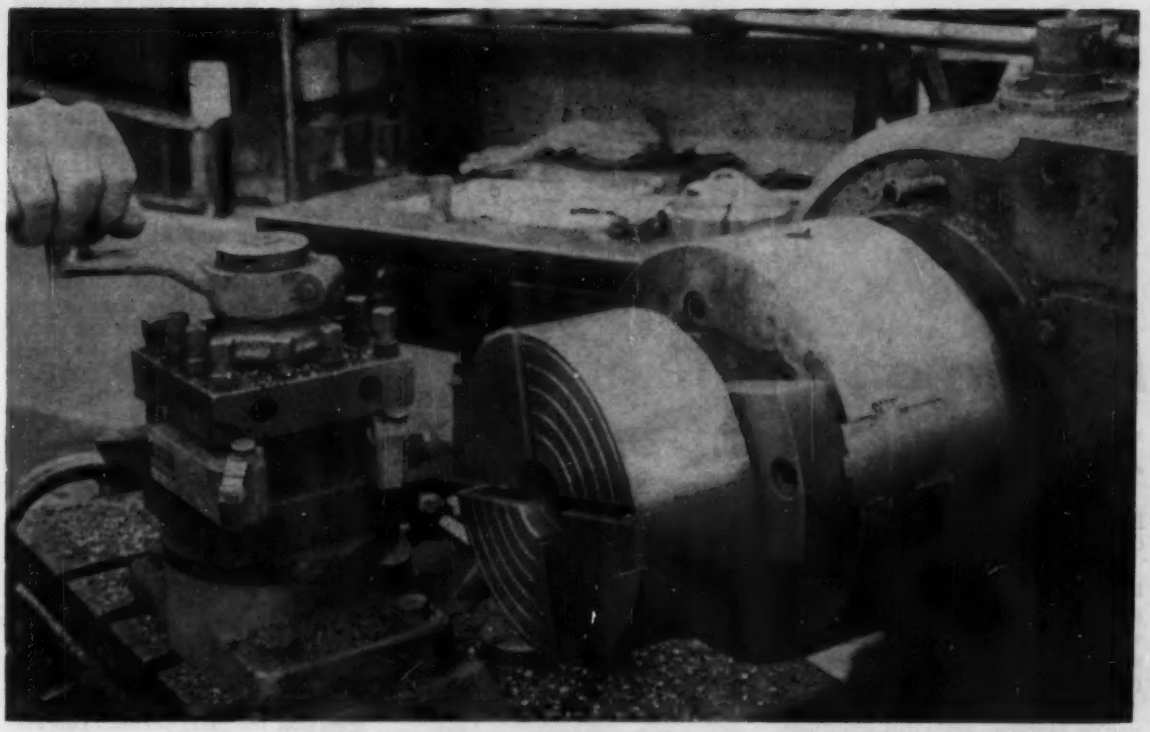


Two oxide tools take rough cuts on cast iron, and produce nearly finished surfaces

Chuck bodies are turned and faced at 1200 fpm as . . .

Oxide tool takes an interrupted cut

High speed and unusual finish are two reasons why oxide cutting tools are being investigated at Skinner Chuck Co, New Britain, Conn. The added advantage of impact resistance on an interrupted cut is an unexpected bonus on the job, which consists of turning and facing cast-iron chuck bodies.

Each chuck body has four cast-in jaw slots, so each revolution of the lathe spindle pounds the tool four times. Experimental setups on several body sizes, ranging from 6 to 15 in. diameter, have convinced Bob Ordway, Skinner machining foreman, that oxide (ceramic) can take the impact and still outperform carbide.

Machining speeds have ranged from 800 to about 1200 fpm, and experimentally to 2000 fpm, with feed rates of 0.016 and 0.011 ipr. These compare to standard settings of 350 fpm and 0.022 (turn OD) and 0.027 ipr(face) for carbide. But carbide cutting has been done with two passes, rough and finish, while the oxide takes a single pass 3/16-in. deep and produces a finish that is "better by far," according to shop personnel.

Tool life at 800-900 fpm and 0.016 ipr is about 10 parts per cutting edge, which is roughly the same as with carbide. Doubling the speed cuts tool life about in half, but the finish stays good.

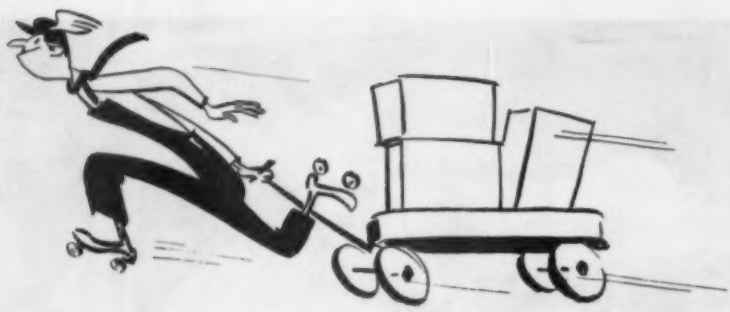
The oxide tool produces hot chips, but stays cool itself and leaves the work barely warm. Edge breakdown is evidently from normal wear and fracture, not heat damage. When the tool has worn nearly to the point of failure, the edges of the jaw slots in the chuck body show up fractured, so the operator has some warning before actual tool failure.

In about two months of intermittent tests, some 40-50 chuck bodies have been machined. Best results have been on cast iron bodies. The oxide tools work in steel, too, but do not show such startling advantages.

Test was made on a 15-hp rebuilt J & L No. 5 turret lathe, which had enough power, but the clutch had to be tightened for the oxide tools. Two oxides mounted with less-than-normal overhang on the front tool turret machined the OD and face of the chuck body separately. In the same turret were mounted a chamfering tool and several small carbide bits that cut the grooves in the chuck face.

The body bore was cut with a carbide tool mounted from the saddle turret (the OD turning can be done at the same time as the boring, which has a slower cycle.)

Tools are Ceroc bits, ½ in. square, with 5/64-in. nose radius and 20° lands 0.008 in. wide. The bits are 5/16 in. thick (deeper than standard for oxides, which may be a factor in resistance to impact). The tools were developed in France (AM/MM —Apr 21 '58, p123), and are now supplied by Gulton Industries. The tool company has developed a brazing technique for oxide tools, and is now trying out a boring bar with brazed oxide bit.



How to distribute your multi-plant product

By Robert T Walls, chief industrial engineer, Propeller Div, Curtiss-Wright Corp, Caldwell, NJ

Do you make your product in several plants instead of one? Are the plants widely separated? Is your product a large one that is expensive to distribute?

If your company fits this pattern, you're familiar with this question: Where to produce how many units? It's a problem that many industries have in common, whether they build appliances, heavy castings, fabricated platework, automobiles, or large electrical components.

This article describes a way to evaluate plant capacity and freight costs, and to develop distribution patterns for any multiple-plant operation that produces a single product. It shows, with simple tables, the best way to distribute the product, from plants to sales districts, at the least cost to the company. If your plant in, say, Indiana can't supply the Chicago sales district (which it normally services) with all it needs, the method will show you how many units to send—at the lowest penalty in higher freight costs—from other plants to fill Chicago's needs.

Happily, the system requires only ordinary arithmetic. Although it would probably be construed as an application of Operations Research, it does not require a wizard.

This article treats of distribution in terms of lowest freight charges. But the system can be amplified to include other factors—labor and material costs, anticipated sales patterns, future expansion. If the proper data is available, the system can be a valuable guide to solution of four major problems:

- Should existing plants be expanded?
- Which ones should be expanded?
- When should new duplicate plants be built?
- Where should these new plants be built?

Basic data needed

To analyze the effect of freight charges on operating patterns, you need the following basic data:

(1) Past sales patterns at various sales levels. These are normally available in any progressive sales organization. Generally, the sales organization is broken down into districts, and the number of units previously sold in any district is easy to obtain.

(2) Incoming freight costs for parts (and materials) that go into the product. With data-processing equipment, freight costs for each supplier-furnished part or material can be punched into a card. The number of parts used in each assembly can then be multiplied by freight costs per part, and all the cards are totaled to give incoming freight costs for each unit made. It might be pointed out here that the nearer the supplier, the lower the freight costs and total costs (if the part supplied meets your requirements).

(3) Outgoing freight costs for each unit produced. This data should be readily available, because shipments go out daily from plants to various locations within the sales districts. From this data, an average mean cost can be found for each district.

(4) Excess costs for overtime units for each plant. These costs could show where delivery of overtime-produced units from the ideal plant might be less expensive (because of high freight costs from other plants) than products shipped from a plant that normally does not serve the sales district.

(5) Capacities of present plants. This information shows the maximum number of units that each plant can produce without overtime, that is, during normal working hours. For future planning, it is highly desirable that this information be broken down by department in each facility; such a breakdown is a big help in finding out how much expansion is needed at each plant to reach future capacity levels.

Setting up tables

After all the basic data is available, it must be put into usable form. With this information, we can construct three preliminary tables, then a fourth that reveals the best operating patterns, in terms of freight charges and plant capacities, for a given sales pattern and volume.

Table I (see p125): This table gives the sum of absolute (incoming and outgoing) freight costs for each plant with relation to each sales district that the plant serves. This cost is the sum of basic data (2) and (3) above. For example, in Table I the absolute freight costs between plant No. 13 and the Boston sales district are $43. In other words, the plant pays a total of $43 on freight charges for (a) supplier components and materials that go into every unit it makes and (b) shipping each finished unit to the Boston sales district. In the example, plant No. 13 is the ideal plant (from the standpoint of freight charges) to serve the Boston sales district, because it is the plant with the least freight costs to the Boston district.

Table II (p125) shows the penalty costs in freight charges—the extra money the company must spend—when the ideal plant for a sales district can't meet the district's requirements. For each sales district in Table I, the ideal plant's freight costs are subtracted from freight costs of other plants that serve the sales district. The resulting table, studied in connection with demand and capacity to meet demand, can be important aid to future planning, and is a basis of analysis for the development of Table IV.

Continuing the example given with Table I, if we subtract $43 (freight costs of the ideal plant, No. 13) from costs of the four plants that can ship to Boston, we have the penalty costs for supplying Boston when plant No. 13 is unable to do so.

For each unit shipped, freight charges from plant No. 3 to Boston are $30 more than from plant No. 13. Similarly, it costs $18 more to ship from plant No. 9, and $65 more from plant No. 15. In Table II, an "X" appears at each sales district in the column of the ideal plant; to flag the first (preferable) alternate to the ideal plant, a circle is drawn around the lowest penalty figure on each line.

Table III (p126) shows the ideal distribution pattern of each plant, based upon the number of units that each sales district has established as its sales volume. To set up this table, obtain from sales districts the number of units to be sold at a given total sales volume. In the table, enter the number for each sales district under the ideal plant (the "X" spot in Table II) for the district. Totaling the vertical (plant) columns gives the number of units that each ideal plant should manufacture to satisfy the needs of sales districts.

Notice that, in the excerpt from Table III given, the Salt Lake City sales district has established 188 units as its quota; San Jose wants 45 and Seattle will need 122. Ideal plant for all three is plant No. 12. Thus the ideal requirements for plant No. 12 are 355 units. (These requirements may, of course, be daily, weekly, or monthly, depending on the product made and the way that the basic data is set up.)

The next step is to compare the *ideal requirements* for each plant with the plant's *actual capacity*. Differences will show which plants have surplus capacity, which are short of adequate capacity to meet the demands of sales districts.

Table IV (p126) compares the ideal and actual capacities, and what to do when the two don't agree. This final step in setting up operation and distribution patterns is the only truly analytical step in the system. Up to this point all steps have involved simple mechanics. Now we must study the penalty chart (Table II) and determine the best ways to fill shortages in certain plants with the surplus capacity of others.

In effect, we must ask this question: If the ideal plant can't fulfill a sales district's needs, what other plant (or plants) can supply the remaining units at the least penalty in freight costs? The answer to this question can involve complex moves. For instance, it may be feasible to fill one plant's shortage from another plant. But what is the result if this move makes the other plant short of capacity? Sometimes, however, the move may be feasible even if the other plant is already short of capacity.

TABLE I – Excerpt

Absolute Freight Costs to Sales Districts from Indicated Plants (Includes Inbound Freight to Plant)

District Sales Office	Manufacturing Plant												
	#1	#3	#4	#5	#6	#7	#8	#9	#12	#13	#14	#15	#16
Boston		73						61		43		108	
Buffalo		74						68		87		67	49
New York		49						42		63		91	79
Pittsburgh		70					81	81		110		49	36
Los Angeles				240	258	99			128				
Salt Lake City			207	275	185	197			181		196	212	
San Jose				248	261	121			105				
Seattle					257	184			167		262		

TABLE II – Excerpt

Penalty Freight Costs to Sales Districts from Indicated Plants (Includes Inbound Freight on Components to the Plants)

District Sales Office	Manufacturing Plant												
	#1	#3	#4	#5	#6	#7	#8	#9	#12	#13	#14	#15	#16
Boston		30						(18)		×		65	
Buffalo		25						19		38		(18)	×
New York		(7)						×		22		49	37
Pittsburgh		33					45	45		74		(13)	×
Los Angeles				141	159	×			(29)				
Salt Lake City			26	94	(4)	16			×		15	31	
San Jose				143	156	(16)			×				
Seattle					89	(17)			×		95		

Table IV shows a very much simplified analysis that covers only a partial pattern (East Coast omitted). In the table, plants and their capacities over (or under) ideal requirements appear in the vertical columns to the left. These capacity surpluses or shortages, it should be repeated here, result from a comparison of each plant's ideal capacity (Table III) with its actual capacity. For example, Table III shows that plant No. 16's ideal capacity to serve Cleveland is 238 units a day; but the plant's actual capacity is 49 units under this total, as Table IV shows.

Let's examine the solutions, step by step, that appear in Table IV:

STEP 1: Plant No. 16's shortage of 49 units would be filled by shipments from plant No. 15 into the Cleveland sales district, at a penalty cost of $12 a unit. Why should plant No. 15, instead of any of the other plants, supply the shortage to Cleveland? There are two reasons: The freight penalty is lower than for other plants; also, plant No. 15 produces 76 more units than its sales district needs, thus can easily supply 49 of these to Cleveland.

STEP 2: Plant No. 4's shortage of 74 units would be filled by:

a. Shipments of 27 units (the remainder of the 76 surplus) from plant No. 15 into the Rockford sales district (served by plant No. 4) at a penalty cost of $7 a unit.

b. Shipments of 47 units from plant No. 8 into the St Louis sales district (also served by plant No. 4) at a penalty cost of $6 a unit. Because plant No. 8 is already 103 units short of ideal capacity, its shortage is now increased to 150 units.

STEP 3: The shortage of 150 units for plant No. 8 would be filled by:

a. Shipments of 100 units (leaving a surplus of 88 units) from plant No. 5 into the New Orleans sales district at a penalty cost of $8 a unit.

b. Shipments of 50 units from plant No. 1 into New Orleans at a penalty cost of $4 a unit.

STEP 4: Plant No. 12's shortage of 32 units would be filled by shipments from plant No. 6 into the Salt Lake City sales district, at a penalty cost of $4 a unit. Because Salt Lake City's ideal plant can't fill its requirements, the plan to move in units from another plant is feasible.

STEP 5: Plant No. 6's shortage of ideal requirements (93 units) would be filled by:

a. Shipments of 88 units (the entire remaining surplus) from plant No. 5 into the Oklahoma City sales district at a penalty cost of $2 a unit.

b. Shipments of 5 units from plant No. 14 into the Omaha sales district at a penalty cost of $11 a unit.

To find the total penalty the company must pay to satisfy the needs of all these sales districts at the lowest freight penalty costs, we simply add the charges shown in Table IV:

49	×	$12	= $588
27	×	7	= 189
47	×	6	= 282
100	×	8	= 800
50	×	4	= 200
32	×	4	= 128
88	×	2	= 176
5	×	11	= 55
Total Penalty			$2418

This $2418 penalty could be per day, per month, per week, or whatever base for capacity and requirement figures is selected. To keep unit quantities as small as possible, the shortest period is recommended.

TABLE III — Excerpt

Sales District Unit Requirements at Daily Volume

District Sales Office	Manufacturing Plant												
	#1	#3	#4	#5	#6	#7	#8	#9	#12	#13	#14	#15	#16
Boston										235			
Buffalo													168
New York								476					
Pittsburgh													141
Rockford			126										
St. Louis			168										
Salt Lake					45								
Cleveland													238
Omaha					82								
Oklahoma City					99								
Los Angeles						328							
Salt Lake City									188				
San Jose									45				
Seattle									122				
Total*	513	557	650	384	507	328	445	476	355	235	273	857	547

*Excluding Non-interchangeable Product Requirements

TABLE IV — Excerpt

Central & West Coast Only

Plant No.	Capacity Over (Under) Ideal Req.	Freight Penalty Plan (Circled Units Are Shortages — Uncircled Filled)				
		Step #1	Step #2	Step #3	Step #4	Step #5
Central						
16	(49)	(49)				
15	76	49 @ $12 (Cleveland)	27 @ $7 (Rockford)			
4	(74)		(74)			
8	(103)		47 @ $6 (St. Louis)	(150)		
14	156					5 @ $11 (Omahn)
6	(61)				32 @ $4 (Salt Lake)	(93)
5	188			100 @ $8 (New Orleans)		88 @ $2 (Okla. City)
1	50			50 @ $8 (New Orleans)		
West Coast						
7	32					
12	(32)				(32)	

Further analysis

The examples given above cover an analysis based on freight costs only. But it is relatively simple to include other factors:

- **Average labor and material costs** for each plant. These costs, of course, will differ, because the operating management and the labor market at each plant will not necessarily produce units with the same efficiency. Too, material costs may vary, depending upon the plant's location. And a plant may make the product so efficiently, that is, at such a relatively lower cost, than another plant, that differences in freight charges may not be so important.
- **Anticipated sales patterns** at future sales levels. Any good sales organization sets up targets for future sales levels. These anticipated sales levels, fitted into Table III, can show which plants will be able to meet future demand, which ones will have to be expanded.
- **Incoming and outgoing freight costs for future plants.** These would be determined after a study of future capacity operating patterns has established desirable areas for new plant locations. They would take into account studies of freight costs and sales concentration in the areas selected for the future plants. If a company plans a sizeable expansion in sales at some time in the future, the potential freight savings could be a heavy influence in decisions to expand by building new plants.

How to write better reports—II

How to organize your writing

By Tom Johnson, associate editor

What is the best way to organize a business report? This article shows the structure that traditionally works best—and tells why. It also gives you a fourth test of your writing, to add to the three tests presented in a previous article

"Order and simplification are the first steps toward the mastery of a subject"—Thomas Mann

Few persons—especially the engineer or management man—would dispute this statement. To solve a problem, the engineer proceeds from the general to the specific. He investigates the problem broadly, analyzes it, and extracts tangible conclusions. He moves, as Winston Churchill likes to do, "from the tossing sea of Cause and Theory to the firm ground of Result and Fact."

Good reports, like good works, are simple and orderly. But *reporting* a study is by no means the same thing as *making* a study. To investigate a problem, the engineer organizes his thoughts and actions one way; to report his findings, he shouldn't take the same path.

If your reports aren't effectively organized, you've probably committed (without realizing it) a very common error: *You have reported your study in the same order that you performed it.*

What is the best way to organize a report? When you have trouble putting the sections of your reports together, try following this rule (which we might call the First Law of Report Organization): **The structure of a good report is directly opposite to the structure of a good study.**

Let's examine this statement in detail. It's closely related to two key rules of good report writing: 1) Get your main points across forcefully. 2) Build your report logically. (A third rule of good writing—Keep your language natural—was discussed in "Three Ways to Test Your Writing," *AM/MM*—Mar 7 '60, p 112-115.)

The study-report pyramid

When an engineer has to solve a problem, he first determines his objective: correcting a fault, recommending a change, proposing a plan. To get to this objective, he must go through three successive steps:

STEP I: He makes a broad but detailed investigation of the subject. This thorough survey collects every detail that affects the subject: background material, complete descriptions of equipment or systems, all technical data (no matter how insignificant).

STEP II: He analyzes the subject. To make this analysis, he weighs every detail in Step I. Next he segregates the ones he wants to use, discarding the rest. Now he collects these usable details into logical groups (with such titles as "Advantages," "Plan A," "Plan B," and so forth). Finally, his analysis shows him the direction that he should take to reach his goal.

STEP III: He arrives at conclusions. These results, stated as proposals (or simply as findings), give his opinion on how the objective is to be met.

This three-step formula for solving a problem has the structure of a pyramid. We may think of Step I as the broad, underlying base that gives stability to the "structure," the organization, of the study. Step III is the apex, the lofty summit that highlights the results of the study.

As any problem-solver knows, the trip from the base to the apex of his pyramid is long and wearisome. But he also knows that the view from this height is the simplest, most orderly one of the subject that he has studied.

From this comparison of a study's structure to a pyramid, we can draw an important moral: *When you write a report, don't make the reader climb your pyramid; he may have trouble getting to the top.*

Let's translate this moral into more concrete terms: In your reports, put the results up front, together with the objective and your proposals for meeting the objective. Don't force your reader to wade through a detailed investigation and analysis before you reveal your secrets. If you follow this organization in your reports, you'll find that it strengthens your writing in several important ways.

Structure of writing that informs

Any good piece of writing has a definite form, one that has a definite purpose. This form, or organization, is closely related to the *chief* goal of the writer: to inform, to narrate, or to describe. One of these three elements dominates almost any type of writing. All

three are likely to be present, but only one of them predominates.

Consider the novelist. He has to *inform* his readers about his characters and settings, and he undoubtedly will *describe* certain scenes or thoughts by painting a word picture. But his chief aim is to tell a story, to *narrate*. In a poem, on the other hand, the writer usually wants to *describe* his subject rather than narrate it or give information.

Without question, the chief goal of a report writer is to *inform*. The distinction here is important, for the organization of many reports is like that of a novel or poem—and incorrectly so. Too many engineers follow the chronological form that the novelist adopts, starting their reports with a lengthy discusson of the earliest event in their study and continuing in sequence to the conclusion. Or, like the poet, they begin their reports with lengthy descriptions of theories. Here the reader who wants a broad view of the forest has to chop down innumerable trees.

Traditionally, writing that informs has a definite organization. We can best see this structure in a news story, in which the "who, what, when, where, why" of a subject appears in the opening paragraphs. Here is a typical opening that puts the results, or the main ideas, at the beginning of the story:

A crowd of angry Staten Island taxpayers broke through police barriers yesterday and threatened to storm into City Hall.

A reserve force of fifty policemen quickly formed a cordon on the lower steps of the hall and prevented the marchers from entering the building.

The near riot erupted after 1500 men and women had made an orderly march up Broadway from the Battery. About half of them broke through the barriers at City Hall Plaza. One policeman was injured.

The march on City Hall was to protest a 27 per cent increase in property assessments on Staten Island.

The news story began on Staten Island and ended at City Hall on Manhattan, but the written report begins on Manhattan—with the results of the valiant march, not the beginning of it. The reader who wants background material or small details will have to look further down the newspaper column. If he wants to know everything about the story, he'll probably have to turn to an inside page (where he'll find the structural base of the pyramid—the detailed investigation—we mentioned earlier).

Magazine articles (especially those that tell of new developments) have the same structure as news stories. But because periodicals aren't published every day, the five "w's" of a newspaper story aren't always essential in the opening paragraphs. In a business or technical magazine (which seeks, like reports, primarily to inform the reader), chief interest is usually in the "why, what" pair. Conclusions or results generally appear at the beginning of the article. Here's an example, from a recent issue of this magazine:

The Bend-O-Matic, a new numerically controlled tube-bending machine, may cause a marked change in manufacturer—distributor responsibilities. In the automotive field, for instance, a distributor of replacement parts can now make his own tailpipes, instead of ordering and storing a wide range of custom-shaped tailpipes from the manufacturer.

Advantages to the distributor are striking: Cost per tailpipe is more than halved; the new machine requires less direct labor, has a much faster production cycle; and the storage space taken up by large inventories of preshaped tubing is sharply reduced.

Reports should be written like news stories and magazine articles. Let's repeat the basic organization: First come the results; second comes the analysis that produced the results; and third and last comes the bulk of the report—the detailed investigation that initiated the study.

Why put results up front?

The organization that we have described above is traditionally the most logical one for writing that informs. Let's see why.

When your report has the main ideas up front, four major advantages immediately become apparent:

1. At once, the reader learns what he wants to know more than anything else—the main ideas. Don't withhold your conclusions (and the proposals that are based on them) from the reader until the end of the report. Remember that you are not writing a mystery story, in which you don't reveal the chief clue until the final page. Suspense can be a very effective literary device, but not in a report.

2. The reader has a concrete basis for evaluating your report. If he knows your objective, the results you got, and the proposals you make, he is at once on solid ground. Nobody likes to learn anything by starting with generalities. Your reader wants you to get to the point as soon as possible. He wants facts, not speculations.

3. Psychologically, you can win the reader over to your point of view. As he studies your report, the reader keeps your recommendations in mind. When he gets to the detailed investigation deep within the text, he'll still remember your proposals. As a matter of fact, he can't help it; once you've oriented him to your main ideas, he'll judge everything he reads in terms of those ideas.

4. The report is easier to write. Every writer has trouble organizing his material. It's the most common complaint an experienced editor hears from would-be authors. The main reason for this confusion is that generalities tend to swamp specifics.

The trick in report writing is *not* to begin with generalities, for you eventually will have to get down to brass tacks with your subject. Because your results are so specific, you establish at once the ideal starting point for a logical presentation of your ideas.

Your results are the concrete building blocks that determine the structure—the order—of your report. When they're the foundation of the structure, the report is much simpler, much easier to build.

The following generalities (universal truths), which crop up frequently in business writing, are good examples of what should not appear at the beginning of a report:

- Rising costs are forcing manufacturers to take a new look at production processes.
- A wide variety of industrial fasteners, for a broad range of applications, is available to industry.
- Any company is in business to make a profit.

Don't forget, too, that generalities tend to be ambiguous. When you write around a subject instead of attacking it directly, your nouns become abstract and your verbs become passive. Your writing loses the natural quality it should have.

Follow this form in your reports

Here's a rule of thumb to follow in the reports you write:

Before the reader gets to the second page, he should know 1) the objective, 2) your recommendations, and

DATE: April 1, 1960

NAME: L. M. Swanson

DEPARTMENT: Industrial Engineering

TO: N. D. Thompson, General Manager

TITLE OF REPORT: Proposed chip-disposal system

WHAT IS YOUR OBJECTIVE?: To improve chip-disposal system by reducing costs, eliminating present safety hazard, and removing storage bottleneck at rail entry.

WHAT ARE YOUR RECOMMENDATIONS?: 1. At machines, store chips in modular steel bins (4000-lb capacity) instead of barrels (capacity 200 lb).

2. Pick up bins with fork truck, instead of moving barrels by hand truck.

3. Dump chips into gondola car instead of storing barrels in freight car.

4.

5.

WHAT ARE THE ADVANTAGES?: 1. Proposed system cuts labor costs 60%.

2. It conforms to good safety practices.

3. It eliminates storage bottleneck, because barrels don't clutter rail entry.

4. Estimated annual savings, $18,000, should pay off cost of new equipment in two years.

5.

(TEXT OF REPORT BEGINS HERE)

This printed form will force a report writer to put his main ideas up front. Here the objective, proposals, and advantages appear on page one of the report, taking up about half the page. Thus the reader gets a clear picture of the main ideas in the study at once

3) the advantages that your proposals, if accepted, will bring.

The form printed on this page shows the information that should open a report. Many companies now have a printed form similar to this, and insist that their engineers use it as page 1 of every report they write. Whatever the terminology, the effect is that the reader gets a clear, concrete view of the subject within a few seconds. If he wants the entire picture, all he has to do is continue to read.

Notice that the reproduced form takes up very little space (only slightly more than half a page). Brevity here is deliberate. It forces the writer to reveal, in a few words, all his main ideas; he can't generalize, because he doesn't have the space.

Notice, too, that five separate entries appear under recommendations and advantages. These force the writer to break down his findings into outline form, instead of lumping them together. Such lists are easier to read, for once again the writer has to be more specific. He can't obscure his proposals by burying them in a long-winded paragraph.

One further point is worth mentioning: The form asks, "What is *your* objective?"—not simply "Objective?" The writer, then, is compelled to take a more personal interest in what he puts down on paper, because he knows that the spotlight is on him, and nobody else.

Keep your main points uncluttered

Whether or not you begin a report with a form, you should recognize the main purpose of the form: It forces you to present your main ideas in a simple, orderly manner. The facts fall into place naturally. Now every fact on a subject has its place somewhere in a report. But remember these two pointers when you sit down to begin a report:

● *Subordinate everything to the main ideas.* Your reader wants to know—more than anything else—your objective, conclusions, and proposals. When too many details appear at the beginning of a report, the main ideas may not get through to the reader clearly. It's best to shove most details, except for the really important ones, down into the body of the report.

Handle your main ideas the way a sports writer begins a story on a baseball game: "Joe Jones hit a home run yesterday in the ninth inning to lead the Rascals to a 3-2 win over the Warriors."

There are a thousand other details about Joe that might be squeezed into this sentence, but they aren't. He may be 29 years old, six feet tall, and the league leader in unassisted putouts by any left-handed first baseman who comes from Youngstown, Ohio. These details, if relevant, appear near the end of the story—not in the vicinity of the main ideas.

In the same sense, a report that you write on, say, selection of an electric motor for a job, should not include every technical fact near the beginning of the report: the horsepower rating, the type of enclosure, the voltage-amperage characteristics, and so forth. If one or two of these details *are* crucial to your proposals, then they should appear with the proposals; otherwise, they can be relegated to the depths of your detailed explanation.

● *Orient your reader to the subject—but briefly.* Background material is essential to an understanding of new proposals. This historical information helps the reader to make comparisons. It gives him an orientation to the subject that prepares him for the changes you recommend.

A good report orients the reader to the subject briefly, but clearly. It does not begin with a long, general introduction that, attempting to prepare the reader for the main ideas, actually deadens the full impact of those ideas.

A college professor once remarked that the average research paper he reads would be greatly improved if the first chapter were thrown away, because it contains nothing but background material. Report writers often make this mistake. Experienced writers break this solid block of background material into tiny bits, and use these tiny bits throughout a report to reinforce concrete facts—not to precede or to dominate them.

A fourth test of your writing

The first article in this two-part series gave you three tests to apply to your writing: 1) at least two-thirds of the verbs should be active; 2) all nouns should have a single meaning; and 3) you should frequently mention yourself or other humans.

Here is a fourth test, one closely related both to natural writing and to good report organization:

In a short passage of your writing, underline the main subject and verb in each sentence. If the subject-verb pattern is consistently the same, sentence by sentence, re-write to vary it.

This test will show if you're guilty of a fault that most bad reports have in common: In these reports, almost every sentence begins with the main subject and verb. Each sentence, in other words, is constructed exactly the same way.

Why does this monotonous construction make the

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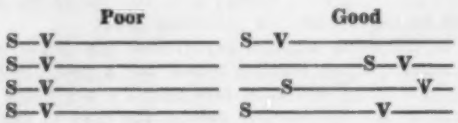
task of *informing* so difficult? Let's answer this question with a series of statements:

- Every sentence expresses an idea.
- When every sentence is constructed the same way, each idea tends to have the same importance (grammatically speaking, of course, each idea *does*).
- But some ideas are more important than others.
- If you vary your sentence construction, some ideas are bound to stand out more clearly than others.
- Good sentence variety makes for good communication, because it ties ideas together effectively. One idea is linked with, and flows naturally into, another idea.

Sentence variety is the spice of good writing. If a reader understands each sentence in a paragraph, but can't grasp the meaning of the paragraph as a whole, the fault usually is that the idea in each sentence isn't clearly related to ideas in other sentences. The following schematics show the distinction between poor and good construction:



A poorly constructed passage (of the sort outlined above) often resembles a list in a catalog, in which every sentence has a number to show that it has no close connection with the sentences that precede and follow it. But when sentence variety is present, ideas almost have to be related. The reader *has to be informed,* because one sentence depends upon another, so that ideas have to be inter-linked. Paradoxically, all this complexity in construction helps make understanding easier.

The horizontal lines in these schematics represent the material that fills out the sentence, amplifying the subject and the verb: adjectives, adverbs, dependent clauses, prepositional phrases, and the like. These add details to the sentence, make it more specific by qualifying the subject and verb.

An experienced writer recognizes the value of this "filler material" to his sentence construction. When he puts, say, a dependent clause at the beginning of a sentence, he builds a bridge between the idea in the sentence and the idea in the preceding sentence. He makes the clause a transitional device that relates ideas.

With this careful construction, the reader crosses the bridge without having to "swim across the river" that separates one idea from another. And because these introductory words push the main subject and verb to the rear of the sentence, the next bridge is shorter, simpler to construct.

(Main subjects and verbs in the two paragraphs immediately above: *writer recognizes, he builds, he makes, reader crosses, bridge is.*)

A good writer—one who supplies transitional words and phrases for his readers—is forced to vary his sentence construction. Unless he does, he simply can't communicate effectively.

Prepositional phrases vs clauses

A book could be written on sentence variety. There is room here to discuss only one major obstacle that report writers create for their readers. Let's preface this discussion with a statement that holds true, our experience has shown, for nine of every ten technical reports: *Report writers love prepositional phrases, but they hate dependent clauses.*

We can express this axiom another way: When a technical writer has to choose between a prepositional phrase and a dependent clause, he'll choose the prepositional phrase nine times out of ten. With this choice, he endangers the chance for sentence variety and the chance to tie ideas together effectively.

What's wrong with the prepositional phrase? Nothing—except that too many report writers over-use it. When a writer strings together five or six of these phrases behind his subject and verb, he lumps together, indiscriminately, a series of details—some more important than others. Here's a typical example (prep phrases underscored):

- Favorable attention is often given in the design of missiles to the employment of titanium for parts because of its high strength in relation to its weight.

Eight prep phrases are in this sentence, following the main subject and verb. Technically, the construction gives to each of the eight details the same importance.

Let's re-write this sentence, reducing the number of phrases and putting the more important details into dependent clauses, which make these "must" details stand out more clearly:

- When they develop missile parts, designers often specify titanium, because it has a high strength-to-weight ratio.

The new version, which has no prep phrases but two dependent clauses (underscored), is much easier to understand. A brief comparison will show why: The original subject (*attention*) is abstract and impersonal; new main subject (*designers*), pulled from the buried phrase *in the design,* is concrete and personal. Original main verb (*is given*) is passive; new main verb (*specify*) is active. And the conjunctions *when* and *because* are attention-getting words, precisely because unlike the original, they tell the reader *when* and *because.*

Dependent clauses, then, *discriminate* among details, highlighting the important ones. Prepositional phrases, on the other hand, merely list details. A good report writer will sprinkle his paragraphs with dependent clauses—not for the sake of variety, but because they help the reader to be informed. The very words that open a dependent clause show why they inform: *because, since, although, why, how, which, that, when, unless,* and so forth.

Don't ignore prepositional phrases—you can't—but don't let them take over your writing. Tell the reader the *because,* the *how,* the *when.* You'll be much more direct, and chances are your writing will be much more active, concrete, and personal.

Most important of all, you'll find that sentence variety improves immensely. Instead of listing details, you'll be analyzing those details. At the same time, you'll find it easier to relate one idea to another, one sentence to another.

Then your reports can be developed logically, consistently. Their structure can help you to communicate.

Pocket-size reprints of this two-part series on report writing are available. Single copies are 50¢; for quantities over 100, price is 40¢ each. Order from Reader Service Dept, American Machinist/Metalworking Manufacturing, 330 W 42nd St, New York 36, NY

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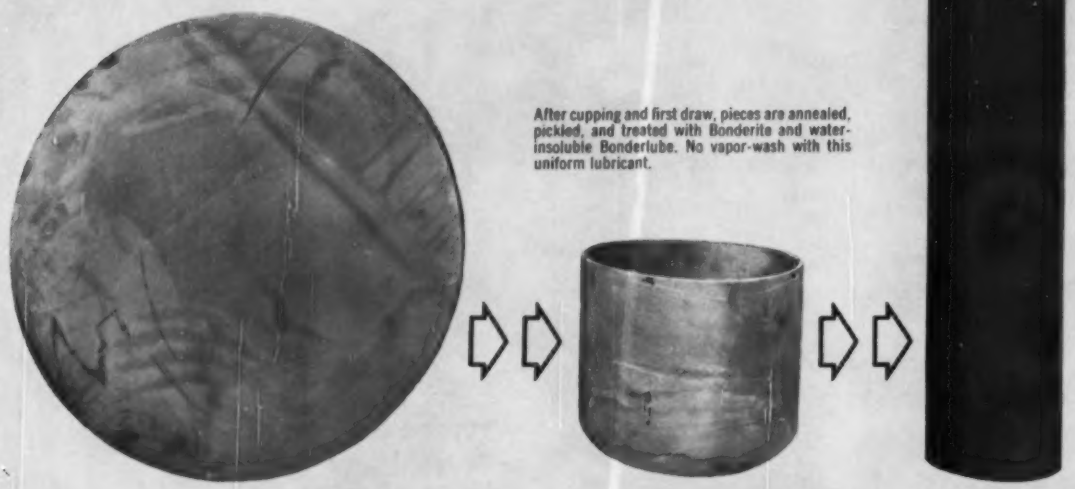
Your Guide to the Best in Aluminum Value

This is the 28-inch blank used in manufacture of large gas cylinders at Norris-Thermador Corporation, Los Angeles, after treatment with Bonderite and Bonderlube. The white, "reacted-on" Bonderlube is a visual check on drawability.

Finish size of cylinder, three operations later, is 8 inches in diameter and 32½ inches long. Only two annealing operations are required from blank to finished size.

After cupping and first draw, pieces are annealed, pickled, and treated with Bonderite and water-insoluble Bonderlube. No vapor-wash with this uniform lubricant.



Increased production at lower costs, real savings with BONDERITE and BONDERLUBE in cold drawing

The press room at Norris-Thermador, Los Angeles. (Photos courtesy Norris-Thermador Corp.)

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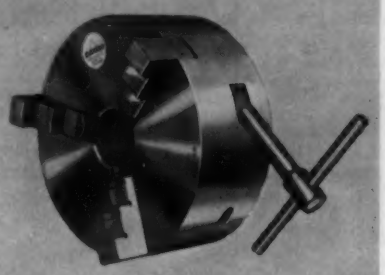
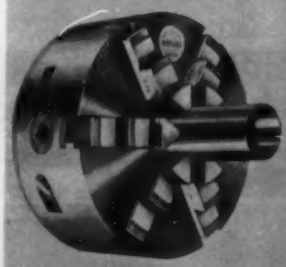


3- and 6-jaw GRIPTRU chucks

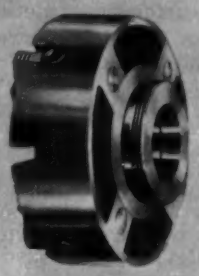
4" to 12" dia.

Concentricity within .0002" TIR!



Chucking work to within .0002" precision takes but one minute. Duplicate parts are chucked to same accuracy at scroll chuck speed. Meehanite bodies. *3-pinions.* Two sets solid jaws.

Available for direct mounting to long taper or D-1 camlock spindles, or, for backplate mounting.



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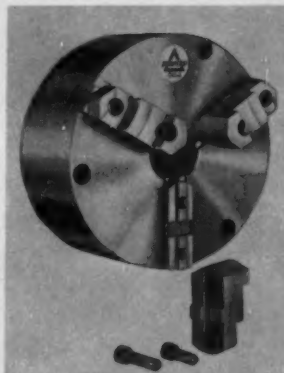
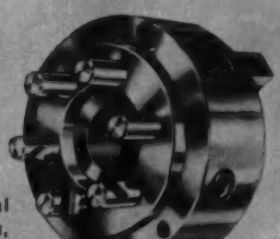
Have rugged Meehanite bodies, case-hardened ground steel jaws, large diameter case-hardened operating screws. Chucks 10" and larger have double thrust bearings.

Available for direct mounting to long taper or D-1 camlock spindles, or, for backplate mounting.



3- and 4-jaw universal chucks

4" to 24" dia.



3- and 4-jaw universal chucks, like Burnerd Griptru, have Meehanite bodies. Scrolls are precision machined from heat-treated alloy steel. Pinions are case-hardened nickel steel—*there are three in each chuck.* Jaws are case-hardened, ground.

3-jaw chucks available with two-piece jaws or two sets of solid jaws—for direct mounting to long taper or D-1 cam-lock spindles, or, for backplate mounting.

336

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CLAUSING DIVISION

ATLAS PRESS COMPANY

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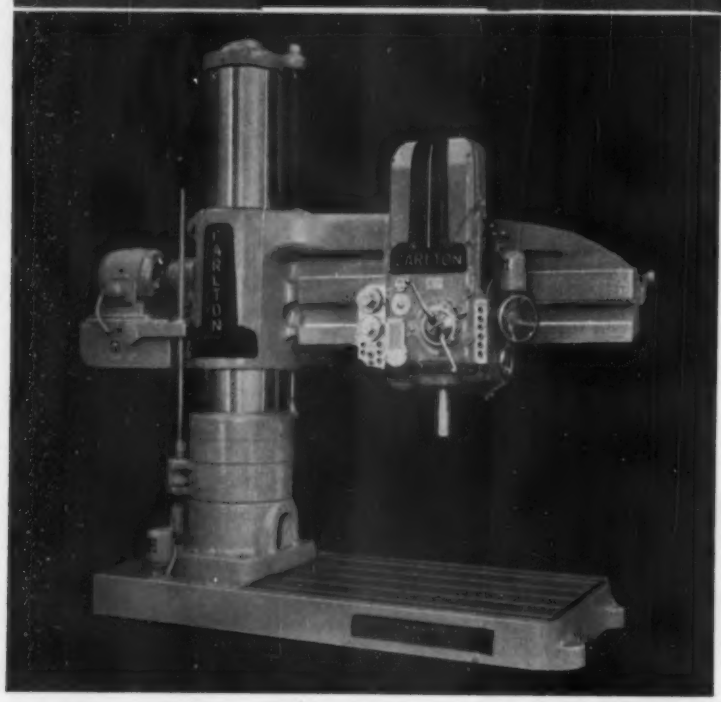
Model	Column diameters	Arm lengths	Speeds No.	Speeds Range	Feeds No.	Feeds Range	Motor recommended
0A	9"	3'-4'	8	20 to 1	4	.006-.020	3-hp
1A	9" 11"	3'-4' 3'-4'-5'	12	25 to 1	6	.006-.025	5-hp 5 or 7½-hp
3A	13" 15" 17"	4'-5' 4'-5'-6' 5'-6'-7'	36	100 to 1	18	.004-.125"	7½, 10, 15, 20 or 25-hp
4A	19"	6'-7'-8'	36	100 to 1	18	.004-.125"	15 to 40-hp
5A	22" 26"	7' to 10' 8' to 12'	36	100 to 1	18	.004-.125"	20 to 40-hp†

*8, 11½, 14 and 18 threads per inch are standard, with various other combinations available.
†Driving motor larger than 40 hp can be used if desired.

Carlton . . . Specialists in Radial Drills

0A 1A 3A 4A 5A



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- Column diameters from 9" to 26"; arm lengths from 3-ft to 12-ft.
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Carlton *Specialists in radial drills*

Definitions for Forming Operations—I

Source: SAE Aeronautical-Automotive Drawing Standards, March 1960, as published by the Society of Automotive Engineers, 485 Lexington Avenue, New York, N Y

Beading (Sheet Metal)—The forming of a small groove, concave impression or corrugation in metal, usually for the purpose of strengthening the part.

Bend Allowance—The amount of sheet metal required to make a bend over a specific radius to a specified angle.

Counterpunch — A conical-shaped depression around a punched hole so that the installed heads of rivets, bolts and screws may be flush with the surface.

Crimped Edge—A condition produced on sheet metal by turning the edge. It may be used to conceal the raw edge of the metal or to strengthen and stiffen the part.

Datum Line—A base line from which calculations or measurements are taken; in body drawing, inch lines or station lines are commonly used as datum lines.

Die Balance Line—A line at right angles to the direction of pierce or draw, shown on engineering drawings to assist in eliminating back draft.

Die Model—An actual size model of a part from which surface is taken for the manufacture of a die.

Die Plate—A master detailed draft of a die formed part.

Flange—A stiffening edge turned on sheet metal, or that portion farthest from the neutral beam axis, designed to carry the bending stresses.

Flare—A small flange around the circumference of a tube at the end.

Forming—Contour lines of formed parts should be proportioned to flange height to prevent unreasonable elongation of material in relation to physical properties. Excessive stretch requires either extra forming operations, annealing or both. Even when flanges are finally formed under such difficulties, the material has thinned out to a degree requiring a review of stress. With SAE 1010 steel blanks having sheared edges, 25% stretch is considered a safe maximum. See Fig. 1.

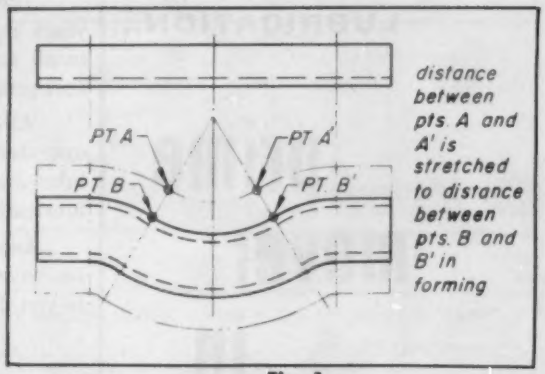

Fig. 1

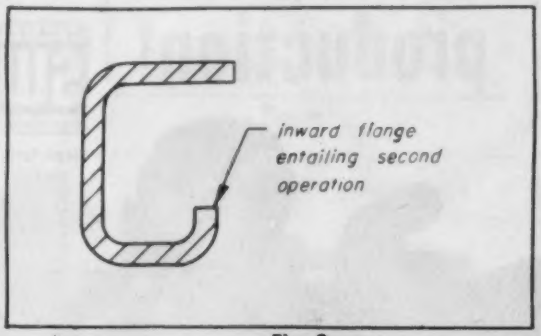

Fig. 2

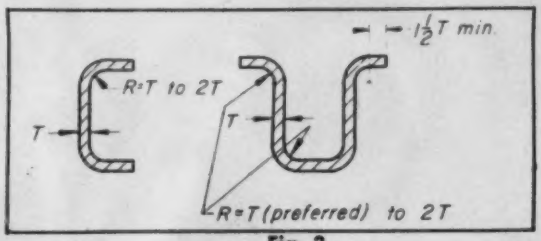

Fig. 3

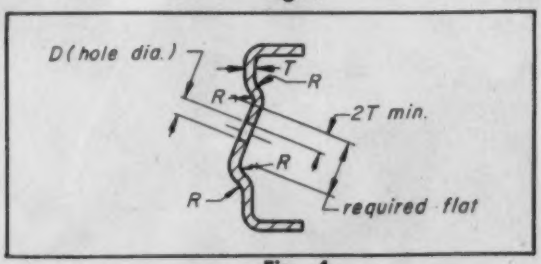

Fig. 4

Flanges formed as shown in Fig. 2 require extra operations and should be avoided.

Inside corner radii of channel and flange forms should be a minimum of metal thickness to give

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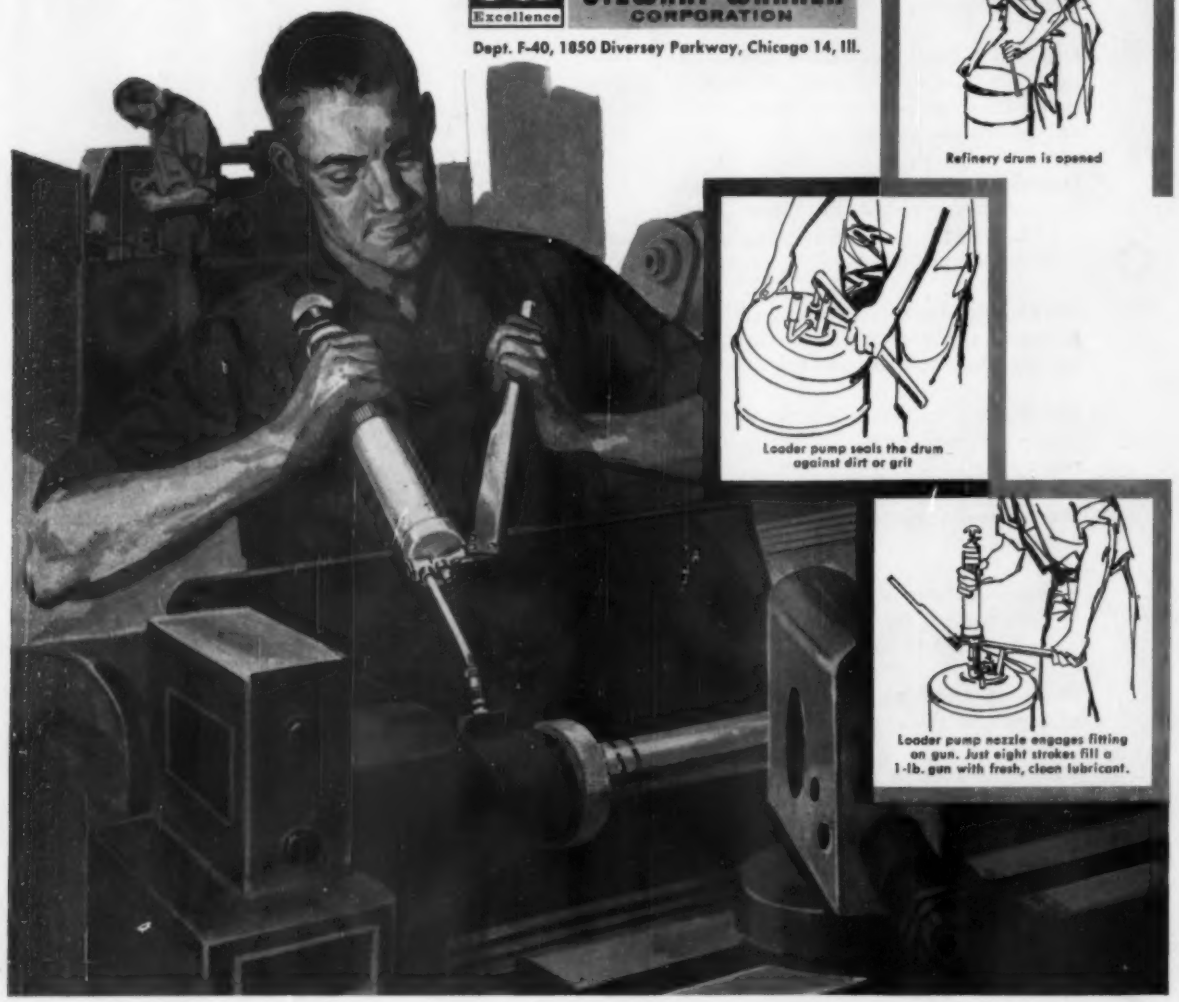


Refinery drum is opened

Loader pump seals the drum against dirt or grit

Loader pump nozzle engages fitting on gun. Just eight strokes fill a 1-lb. gun with fresh, clean lubricant.

Definitions for Forming Operations—II

optimum conditions on the finished stampings. See Fig. 3. In cases where panels are formed or embossed into a surface, the radii should be as generous as clearances will allow, but never less than the stock thickness, and the flat panelled area should be as large as possible. Large corner radii prevent metal tearing and breakage. The large flat allows some tolerance on corners of forming tools after they have worn slightly and tends to minimize tool repair cost. It also gives a greater area seat for perforating dies when holes are punched after forming, thus preventing coining action by die buttons. See Fig. 4.

When formed sumps or panels are required, a suitable slope should be allowed to eliminate locking on the punch and consequent risk of cracked stampings. See Fig. 5.

Ends of bars tend to crack in the corner radii when forming. To relieve this condition radii should be increased if possible. See Fig. 6.

On any formed part which has a decidedly sharp contour radius the flange should be increased. See Fig. 7.

Forming and Gage Notch—Similar to Gage Hole.

Gage Hole—A hole located in a part to insure proper location during fabricating operations. Also known as "Fool Proof Hole" or "Tooling Hole."

Hem Flange—A flange which is formed through 180° to "double back" on the basic metal surface. It is used to avoid exposed raw edges of metal or to join two panels together.

Holes—In general, holes are perforated in the flat blank whenever possible. This is not possible in extreme contours, nor too close to the bend line of a channel section unless distortion is permissible. Where such can be tolerated, permissible distortion should be specified. As a general rule, the edge of a hole should not be closer than three metal thicknesses from the outside face of web. This must be increased proportionately for large holes and holes in contoured sections. See Fig. 8.

The conditions in Fig. 9 (a) through (d) show minimum stock requirements around holes used for bolts, clips or rivets. Spacing of groups of pierced holes should be such that minimum stock between holes is no less than shown.

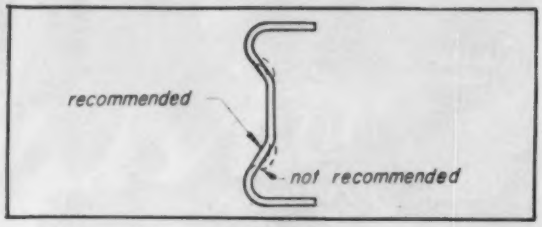


Fig. 5

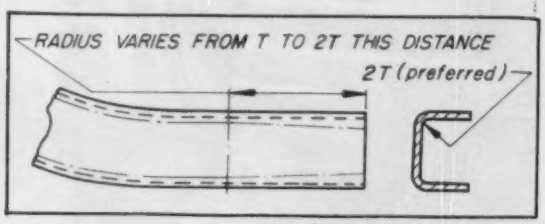


Fig. 6

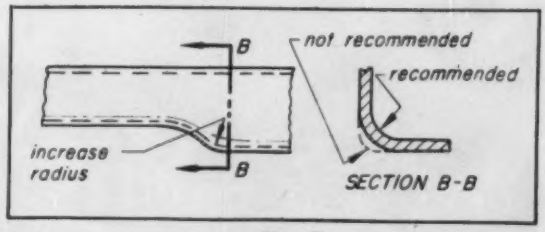


Fig. 7

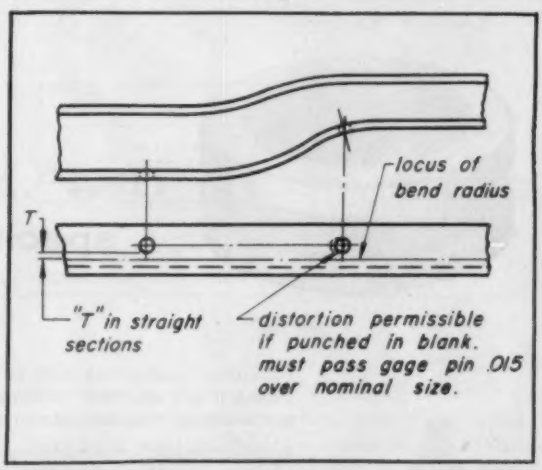
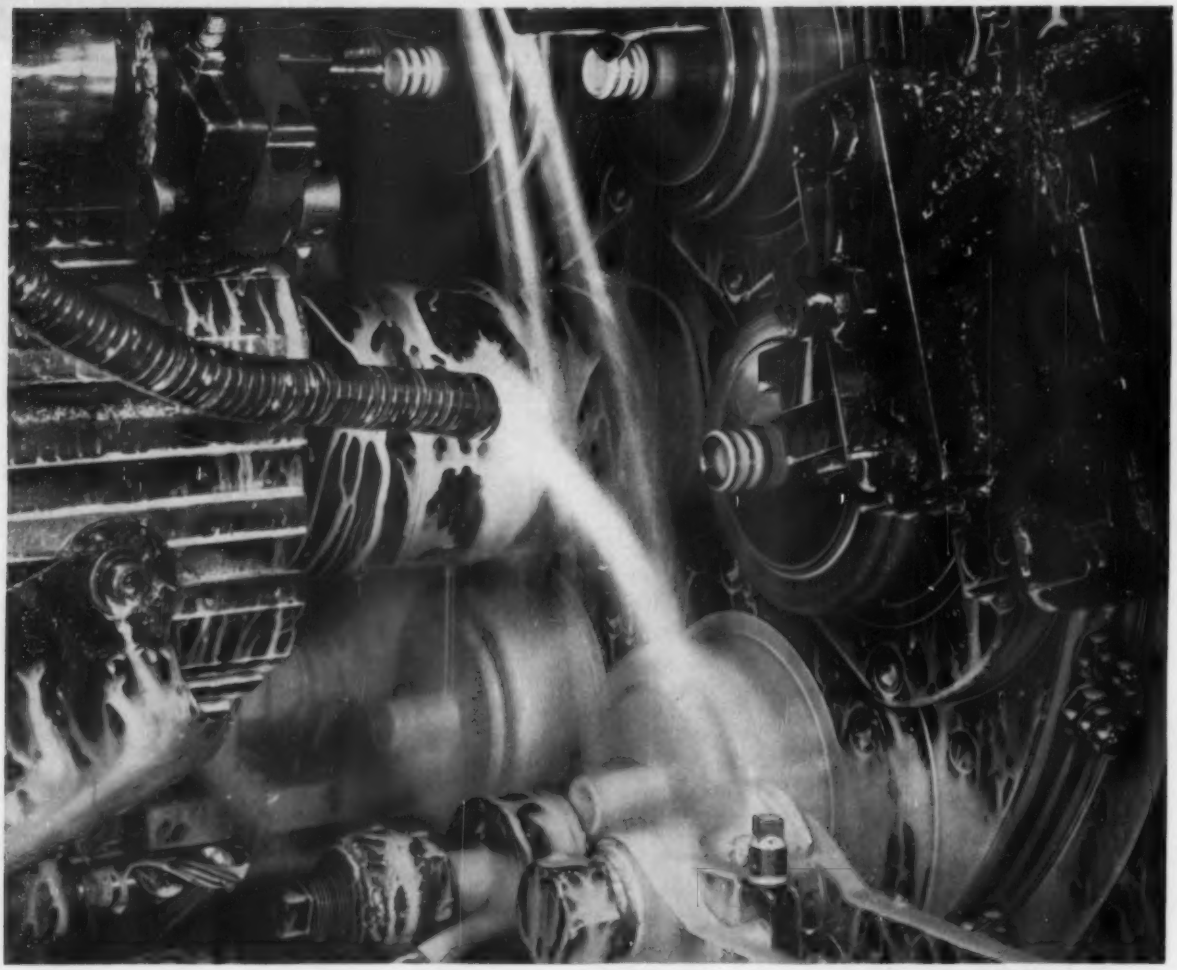

locus of bend radius
T
"T" in straight sections
distortion permissible if punched in blank. must pass gage pin .015 over nominal size.

Fig. 8

The straight side of an oval hole can be flanged to any height within the limits of the material available; however, this does not apply to the rounded ends of the hole. At these points, allowable elongation must be the controlling factor. A 15° angle is desired on cupped holes. See Fig. 10.

American Machinist / Metalworking Manufacturing REFERENCE BOOK SHEET



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Definitions for Forming Operations—III

Inside of Metal—The surface of metal which is formed by the male part or punch side of the die; the surface of metal to which the die model is made; the surface of metal to which the part drawing is made; the surface to which contour lines are drawn on the metal draft.

Lightening Holes—Holes that are incorporated in parts for the purpose of reducing weight.

Metal Draft—A thin sheet of metal, usually aluminum, properly painted, on which lines are drawn for accurate layout work. Sometimes referred to as the aluminum draft or plate.

Normal Surface of Metal—The general contour of the part excluding any local deformations.

Ogee Curve (OG)—An "S" curve; a reverse curve; a compound curve.

Panel Tipping—The act of redrawing a part in a newly desired position. In body work it usually refers to revolving a part into the die strike position.

Piercing—The process by which any hole or inside portion of a part is formed by means of a pointed tool.

Pinchweld—The spotwelding together of two metal flanges with raw edges pointing in the same direction.

Punching—The process of forming holes out of sheet metal by use of a punch and die.

Rolled Section—A continuous shape such as angles or channels, formed by passing strip stock through a series of progressive rolls.

Shear—The separating of metal by displacing two adjacent sections in opposite directions by means of a cutting tool. This operation includes blanking, perforating, trimming, slitting and parting.

Spring Back (Metal)—The angular amount by which a metal returns toward its former position, after being bent through some specific angle.

Templet—A pattern or guide used for fabricating or checking the shape of parts. A template may be made of any suitable material, but is often made of aluminum because of its rigidity and noncorrosive properties.

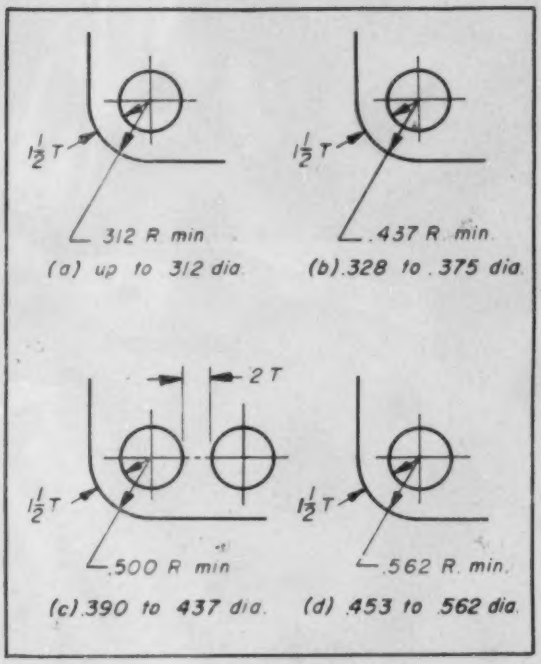


Fig. 9

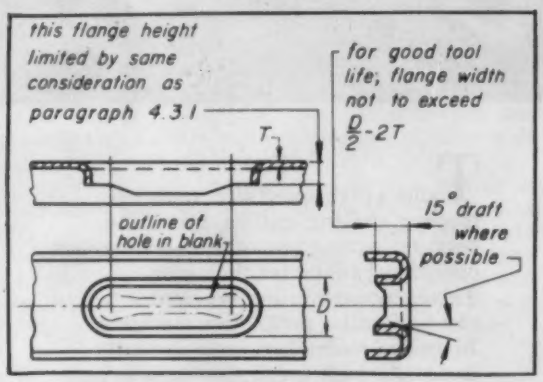
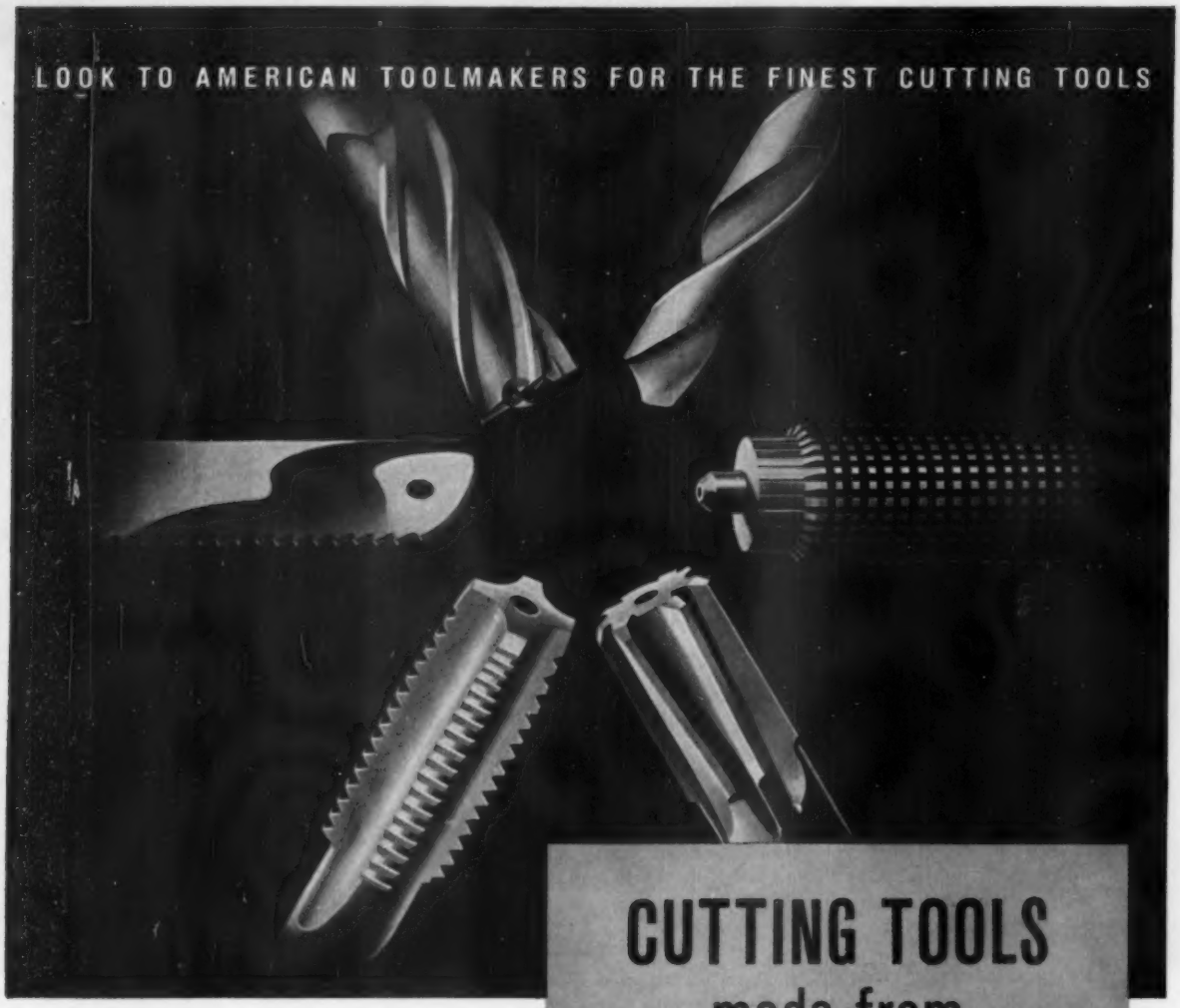

this flange height limited by same consideration as paragraph 4.3.1
for good tool life; flange width not to exceed D/2 - 2T
T
15° draft where possible
outline of hole in blank
D

Fig. 10

True Sweep—A true radius; usually refers to a large radius. Also, the wood, plastic or metal templates used as guides in drawing true arcs with radii too large to be drawn with conventional drafting instruments.

Workline (WL)—A term used by draftsmen to indicate the datum or reference from which distances are measured when drawing or checking a view. In theory, this line represents the intersection of two planes of projection which are at right angles to each other.



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Talking Shop...

Long Walk

ONE OF OUR EDITORS was talking with a manufacturing engineer recently and, as so often happens these days, the talk turned to the Machine Tool Exposition in Chicago next September. "Are you going?" our man asked. "I'll be there if I have to walk," the engineer answered. This was impressive because the walk would be almost two thousand miles—each way. We hope he gets to ride. We also hope he plans to stay long enough to really see the many new machines that will pack the Amphitheatre.

Wild Guess

SPEAKING *of* the Machine Tool Exposition, the question we are most frequently asked is, "Will there be much numerical control in Chicago?" We will now stick our long neck out and make a guess that there will be more than 75 and perhaps nearer a hundred machine tools with numerical control on display. At the same time, we should emphasize that there will still be several brand new machines without tape for each new machine with it.

Model Toolroom

SPEAKING of shows the Tool Show now going on in Detroit has a booth that includes a model toolroom—model in the sense of miniature and not in the sense of perfect. The people who are exhibiting it (us) are running a contest to make it a model toolroom in both senses. The prizes are generous and the contest should be a lot of fun. Drop in to Booth 1849 and take a look.

Translation

WHEN EFFORTS to translate by machine were in an early stage, this phrase was fed in: "The spirit is willing, but the flesh is weak." The machine was asked to translate it into Russian, then a translator put the Russian back into English. It came out: "The liquor is still good, but the meat has gone bad."

Never Too Rigid

TOOL LIFE in facing brake anchors on a Bullard was increased from 2½ pieces per grind to 8 pieces per grind. The improvement was made at Allison Div of GM by Tom Walsh who accomplished it by changing the setup so the tool overhang from the turret face was reduced from 10 3/4 in. to 8 1/8 in. Which proves again that you can never have too much rigidity in a cutting setup.

New School

Dr Paul Schwarzkopf is developing a new type of school in Austria. Called a "Techno-Gymnasium," it is a combination of technical high school and college. Boys will not only learn all subjects of high school plus two years of college, but will receive practical training in laboratories and shops. The school will be free for the students, most of whom will live on the campus.

Fixed Wing

A POPULAR STORY in aircraft circles at the moment tells about the company building military planes that was experiencing difficulty with the wings falling off. This was extremely awkward and the engineering department worked night and day to correct the problem. They tried everything and everything failed.

One night when a conference was reaching the desperation stage, the man emptying the wastebaskets in the conference room interrupted to suggest that they try drilling a line of holes at the wing root. Being desperate, they tried it and there was no further difficulty with wings dropping off.

Delighted, the engineers sought out their advisor to learn the theory behind this discovery so they could explain it to the appropriate officers in the military service. "Well, it's really very simple," said the man. "You see, I've been a janitor for 25 years and I have yet to see toilet paper tear at the perforations."

No Fuss, Please

THINK TWICE before you pin a medal for long service on a veteran employee if it happens to be a woman. Making a fuss over her long stay with the company reminds her of her age, says Industrial Relations News.

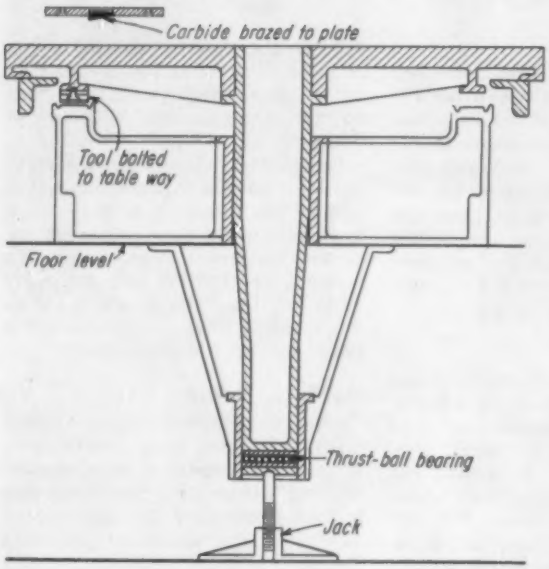
Too Easygoing

NEWS THAT the pilot of a crashed plane may have been taking tranquilizers is a reminder that safety engineers often warn that a man taking tranquilizers is a safety hazard. Time study men have also discovered that a tranquil worker is not always an efficient one.

One answer may be a new drug, Trancopal, that is claimed to relax muscular pains and aid overanxiety without interfering with the performance of manual or intellectual tasks. Better consult your doctor before grabbing a bottle, however.

Practical Ideas...

Vertical-Boring Mill Reconditions Its Own Ways



Upon removing the table of one of our 10-ft. vertical boring mills we discovered why we hadn't been getting the accuracy and finishes we were accustomed to. The ways of the table and the machine's base were badly damaged by steel turnings and failure of the oiler system.

Ordinarily, this would have meant only one thing; we would have to dismantle the machine and send the base out for remachining to a shop equipped to do this kind of work. In view of this, we sought and received cost estimates of from $2500 and up which we considered excessive though we placed great value on the machine.

After giving the situation some thought, we decided to try our skill at doing the job ourselves. The first operation was to face off the table way, which we did in another mill. This was followed by constructing a cutting tool made up of a carbide blank braced onto a steel plate. After drilling two holes and counterboring them, the back of the plate was ground clean. Turning it over, the carbide was ground parallel and backed off to provide a cutting edge. Detail of the cutter is shown in the upper-left corner of the sketch.

The hole locations in the plate were then transferred to the table way where blind holes were drilled and tapped for mounting the cutter. This done, the table was lowered into the base where the drop was controlled by a ball-thrust bearing on a back-up plate supported by a jack.

While I operated the machine at a low RPM, one of my men fed the tool into the base way by means of carefully lowering the jack. So painstakingly was this operation carried out that it consumed two hours, but the result was gratifying.

After removing our equipment and cleaning up the tapped holes and the machine in general, we repaired the oiler. Replacing the table and checking it for accuracy showed that it was as good as the day it was bought.

Clarence Lacher, superintendent, Golden Anderson Valve Specialty Co, Pittsburgh, Pa

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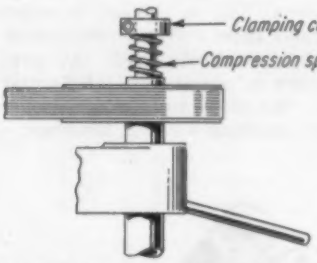


Spring Saves Small Drills

A suitable spring, slipped over the spindle spline and backed up with a collar, will remove the cause of small-drill breakage. The spring acts as a buffer to take up the slack in the spindle and prevents the sudden break-through such slack helps to accelerate.

The collar can be set to create more or less compression as desired by the operator. The least effective compression is obtained when the collar is set to contact the spring just before the point of the drill breaks through the work. But more than minimum compression is usually safer.

Any material can be used in making the collar, but if it is steel, a brass or bronze washer placed between the collar and the spring, will reduce wear. Note that the spring is wound so as not to dig into the collar or machine under right-hand rotation.

This gimmick has saved us considerable time in work stoppage and it has reduced the cost of replacing small drills.

F Murray, Detroit, Mich

Magnetic Blocks Replace Assembly Fixtures

Methods-improvement studies at our plant have shown the need for bench-top holding fixtures to assist in assembling small parts. Securing subassemblies to the bench provides the operator with that often-needed third hand.

In the past, we have been making poured-plastic nesting fixtures at an average cost of $50 each. In each case, one fixture could only be used on one assembly.

Now, we have found a ridiculously simple means of holding these components—with standard magnetic blocks. On a steel-capped bench top a magnetic block will hold itself and the part firmly without hold-down bolts. And too, the blocks are adaptable to any assembly regardless of shape.

We made a survey on the cost of our past fixtures and found that a $200 outlay for magnetic blocks would have saved us $3000. This is an indication of greater savings in the future of new products.

Cy Collett, manufacturing engineer, IBM, Rochester, Minn

Adapters Speed Tool Changes

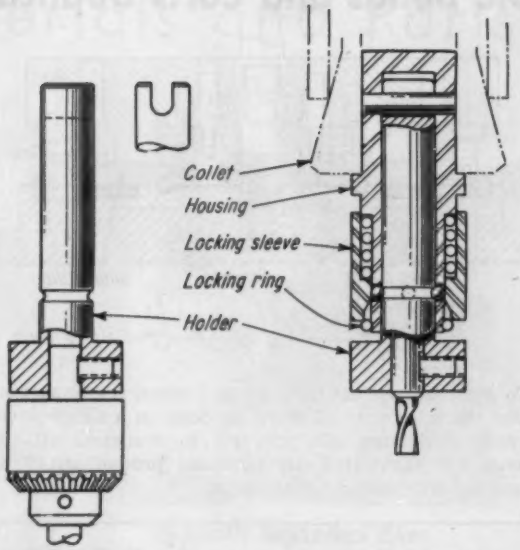
While machining a workpiece in the milling machine, it is frequently necessary to perform several operations during a setup. Tool changes will therefore have to be made; for example, if a vertical head is used, one type of end mill will have to be exchanged for another or a drill may be replaced by a counterbore and so on.

Normally, this means that the draw bar has to be loosened to release the tool, and in many cases, the collet must be changed to take the tool-shank size. All told, these changes add up to a considerable amount of lost time, particularly where many tool sizes are used in a series of operations.

To reduce this element of waste between each necessary step, I have designed and built quick-change adapters for a number of standard shank diameters. The toolholder parts of these adapters are fitted with the various cutters needed on the job before me including one to take a drill chuck for drills, reamers, and counterbores.

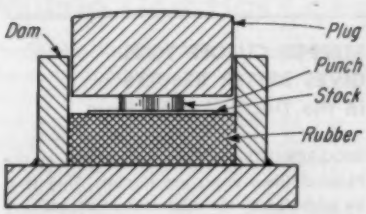
The working principle of this tool is simple. After an adapter housing has been placed in the collet, merely push the toolholder into it engaging the driving pin with its forked end. Removing the holder is just as easy. All you have to do is to stop the machine, lift the locking sleeve against the spring pressure and pull the sleeve out.

All machined parts are made of tool steel and ground after hardening. The toolholder must have a slide fit in the housing bore; any clearance, even the slightest, will cause a cutter to wobble and chatter. The driving pin is a commercial dowel, and the peripheries of the locking sleeve and holder collar are knurled.



In drilling the holes for the locking balls, a small burr should be left to prevent their dropping through into the bore. In other words, when drilling from the outside, the drill should not be allowed to penetrate the entire wall thickness; just the point of the drill can. Once a spring has been slipped over the housing, and the locking balls placed in their holes, the sleeve is positioned and retained with a ring to complete the assembly.

Glen E Price, Caney, Kansas



Prototype Parts Blanked in Rubber

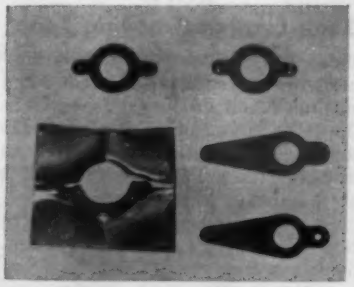
In the construction of electronic equipment, it is sometimes necessary to prototype small parts prior to designing permanent tooling. These parts are generally of light material and we have, for some time, been using a simple inexpensive method to blank and form them.

The setup calls for a rubber dam, either round or square, to take a piece of rubber twice the size of the largest part to be made. Into this is fitted a piece of ½ to 1 in. thick rubber. A plug is next made to fit inside the dam and long enough to extend about 1 in. above the dam as it rests on the rubber. This comprises the basic tooling which, to do a job, requires only a punch of the shape wanted.

A punch is made of tool steel, its thickness roughly 6 to 8 times that of the material to be blanked. We have found a ⅛ in. thickness a well-working standard for thin material. After a punch has been made to the shape desired with holes, indentures, or bends, it is hardened and ground to a good edge.

To make a blank, lay a generous piece of the material on the rubber, center the punch on top of it and insert the plug. Now place the assembly in a hydraulic press and apply pressure. For light-gage stock, an arbor press will do fine.

This method works well on stock up to 0.025 in. thickness which, so far, has been our maximum. It does, however, leave a great deal of waste as compared with the blank produced, but on short runs like these, this is of no consequence.

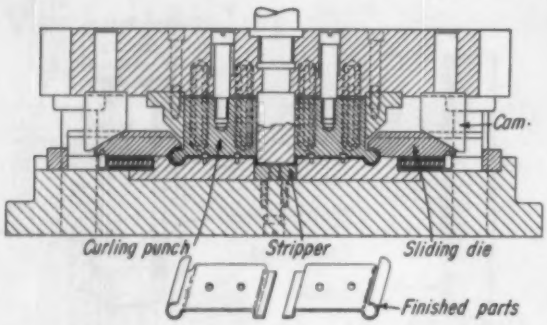


Some samples are shown in the above photo. The piece at top left has been blanked from the 0.016-in. thick steel shown directly below it. The pieces at right, starting at the top, are: 0.005-in. brass, 0.011-in. brass, and 0.0035-in. steel. All are cut as cleanly as if they had been made in a standard die.

Armon L McDowell, Portland, Oregon

Practical Ideas...

Die Bends and Curls Duplicate Parts With Each Stroke



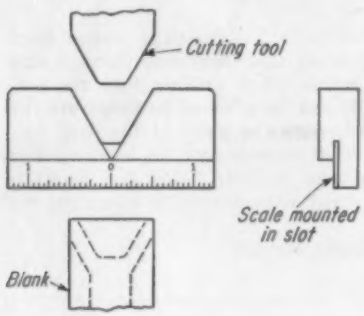
To get the most out of a die and press, it's important that the maximum of work be done in a single press cycle. Following this principle in designing all our tools, the illustrated die increases production 100%, loading and unloading excepted.

In operation, two pre-punched blanks are placed on locating pins of the forming die. As the press ram comes down, two spring-loaded curling punches contact the workpieces, holding them firmly as end curling begins. The four compression springs in each punch are stiff enough to hold the pieces on the locating pins.

Further descent causes cams at both ends of the die to activate sliding dies that move in to finish the curling operation. At the same time, and during the last ¼ in. of down-stroke travel, a forming punch makes identical step bends on both pieces with a stripper plate acting as the bottom of a forming die.

On the upstroke, the curling punches maintain their hold while the sliding dies move back against stops. Not until the heads of the stripper bolts, governing the punch travel, hit the counter-bore bottoms is this pressure released. The parts then follow the punches to top dead center where they are stripped off the punches either manually or by a mechanical device.

Hjalmar Dahl, Upplands Vasby, Sweden



Gage Locates Grooving Tool

This easily-made gage makes simple work of centering the tool when cutting V-belt grooves on sheaves in the lathe. In addition, it also checks the angular position of the tool so its axis is at right angles to the axis of the sheave blank.

In following the directions of the blue print, which generally gives dimensions from the edge to the center of work, the gage is calibrated to read in either direction of the center mark. In use, the V-notch in the gage is placed over the tool after which both are moved forward until gage touches the work.

The first check is then to see that the gage lies flush against the work. If not, the tool angle is corrected. The next step is to position the tool longitudinally. This means the carriage has to be moved so the center of the gage reads the required dimension from a specified face; or, for a centered groove, that both sides of the zero mark read the same.

Being made of flat-ground stock for heat treating after machining, the gage is squared up on all sides and marked with a center line. Next, the V-notch is cut into one edge to suit the tool angle used. This is done so the included angle is equally divided on both sides of the center. A narrow slot is then milled along the opposite edge and approximately half of the slot depth is removed on one side. This is to expose calibrations of a piece of scale with numerals altered to read in both directions from a zero. The scale is pressed into place after the gage has been hardened.

We have also made up a step-spacer block which we use to set the cross-feed stop. This is to predetermine the depth of various groove sizes and to prevent mistakes. The spacer block carries several dimensions, some of which are too large for setting groove depths, but are useful for other jobs.

E Brunslik, Milwaukee, Wis

W E Stengle
Enid, Okla
Won $25 for his idea:

STEPPED CUTOFF TOOL GIVES BETTER RESULTS
in the Dec 28, 1959 issue

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning idea is made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

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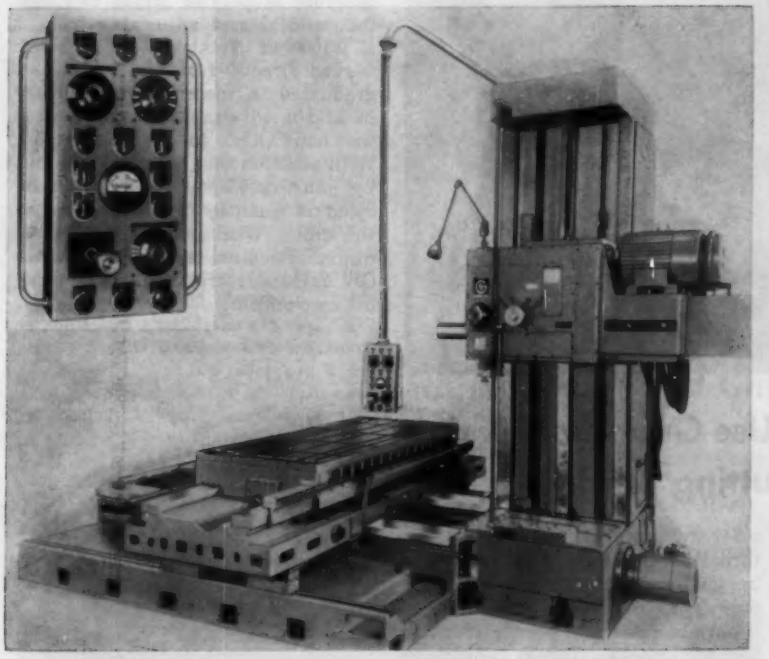
WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co. Inc, and those of its advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

New Shop Equipment

Materials and Parts



G&L Six-Inch Horizontal Boring, Drilling, Milling Unit Has Complete Pendant Control

Complete pendant control of every machine function, joy-stick control of milling feeds, a three-way column and a motorized headstock are featured on this Giddings & Lewis six-inch spindle horizontal boring, drilling and milling machine.

Pendant provides the operator with remote control of headstock, spindle, table and saddle, including start, stop, direction, traverse, feed, speed and electro-hydraulic clamping. Independent saddle and spindle feed is provided as well as combination feed of the two for uninterrupted machining of long bores. Head, table and saddle milling feeds can be operated independently or in any combination. Spindle feeds and speeds can be preselected while the spindle is running.

A joy-stick directional control is provided for milling feeds and rapid traverse to headstock and table. Moving the stick up or down moves the headstock up or down; moving it right or left moves the table right or left. Moving the stick at any of four 45° angles moves headstock and table simultaneously.

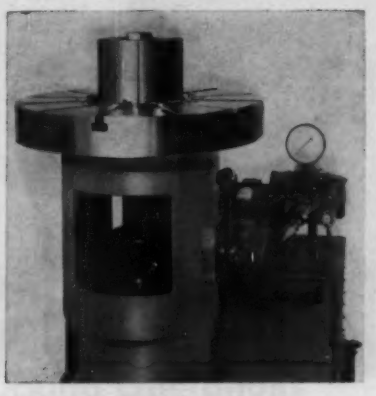
The machine is designed to receive all automatic control systems, including numerical control, electronic or hydraulic tracer and electric positioning. It is equipped with a motorized headstock powered by a 30-hp motor.

Among the table arrangements available are: two-way bed, two-way bed with in-the-floor supports, four-way bed, and four-way bed with in-the-floor or over-the-floor supports. Roller bearing saddle supports ride on hardened steel strips to provide 24 lines of contact.

The machine is also available in a five-inch spindle model.

Giddings & Lewis Machine Tool Co, Fond du Lac, Wis

MORE DATA? Circle 51, inside back cover



Hydraulic Expanders Have 62 or 93-Ton Maximum Pull

Hydraulic expanding machines E-62, with a 62-ton maximum ram pull, and E-93, with a 93-ton maximum ram pull, can be furnished for stretch-forming metal cold or water-cooled for work with metal at high temperatures. They can be used to stretch sheet metal cylinders, cones or bands.

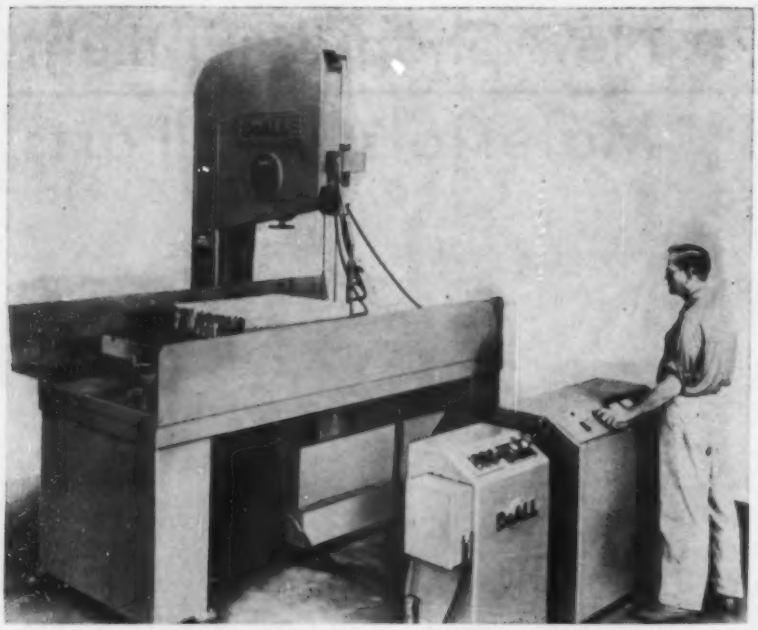
The main part of the machine is cast Meehanite and is equipped with 12-segment master jaws 6 in. high. Minimum dia is 7.562 in.; true dia is 9 in.; maximum dia is 9.158 in. It can be run at six cycles per minute.

Greenerd Arbor Press Co, 41 Crown St, Nashua, NH

MORE DATA? Circle 52, inside back cover

INDUCTION HEATER is a semi-automatic, low-frequency unit for heat treating rollers and wheels in diameters from 6 to 14 in. Power source can be either a direct line 60-c or Multiductor 180-c static frequency converter — *Ajax Magnethermic Corp, Youngstown, Ohio*

MORE DATA? Circle 53, inside back cover



A metal-bonded or resinoid-bonded diamond wheel is used to produce clean, burn-free wafers. Table driving mechanism provides smooth feed, infinitely adjustable from 0.100 to 144 ipm with rapid table positioning adjustable to approximately 25 fpm. Cross feed is actuated automatically at the beginning of each cycle by a hydraulic-mechanical arrangement, accurate to plus or minus two ten-thousandths and adjustable from 0 to 0.1000 in. Total amount of index is read directly from the handwheel graduated in increments of 0.00025 in. and is adjustable independent of the handwheel to facilitate setup. With addition of a wheel sleeve and by ganging wheels, wafers can be diced in quantity with one pass of the table. Where only dicing is required, machines are available without automatic crossfeed and indexing mechanism.

Brown & Sharpe Mfg Co, Machine Tool Div, Providence 1, RI

MORE DATA? Circle 55, inside back cover

Do All Band Machines Use Quenched Electric Arc for High-Speed Cutting of Honeycomb

Line of three Electro Band Machines, using an electrical machining process known as quenched arc cutting, is designed to cut honeycomb of aluminum, stainless steel or titanium and other fragile cellular structures made of foil or thin-wall tubing.

Work at ground potential is fed into the rapidly moving saw band carrying a low-voltage high-amperage current that arcs between the leading edge of the band and the workpiece. A flood of coolant limits or quenches the arc.

Cutting rate is 5 to 50 sq in. per minute for finely finished work and 150 to 200 sq in. per minute where finish of the foil edge is not important. Surface flatness ranges from ±0.003 in. tir at the lower rates to ±0.0156 tir at maximum rate.

Because the cutting is accomplished by an electric arc, there is no pressure on the work or cutting band. Wire can be used instead of a saw band and fixturing need only be strong enough to hold the workpiece in a vertical position.

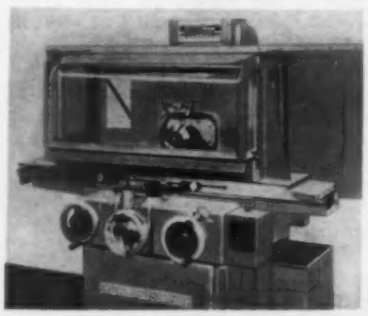
Model 1612-XI, rated at 5 kw, has a 16 in. throat, 12 in. work height. It operates at 5500 fpm band speed and is powered by a 3-hp motor. Work-table is hydraulically operated with 12 in. traverse and feed rates up to 3 fpm.

Model 3624-XI, (illustrated) with a 7½ kw power supply, has 35¼ in. throat depth, 24 in. work height, 43 in. table traverse, 8 fpm feed rate, 6000 fpm band speed, 5-hp motor.

Largest and most precise machine is model 2648-XI. Throat depth is 26 in., work height 48 in., table traverse 48 in., power supply 10 kw, drive 5-hp, feed 0.03 to 11 ipm.

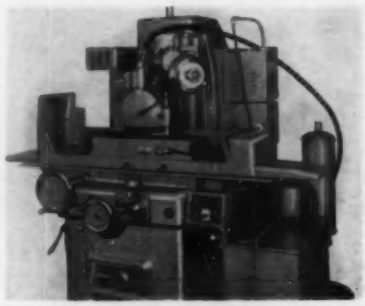
DoAll Co, Des Plaines, Ill

MORE DATA? Circle 54, inside back cover



B&S Slicing and Dicing Machine Handles Semi-Conductor Materials

The 618 Micromaster automatically wafers materials such as germanium, silicon, and quartz crystals with parallel accuracy to one ten-thousandth of an inch and reportedly consistently repeats in size to plus or minus two ten-thousandths.



Incremetic Down Feed Designed For Saddle Type Surface Grinders

New automatic down feed device which permits operator to preset amount of stock to be removed and automatically shuts off after stock removal is now available on all Grand Rapids surface grinders from 6 x 18 to 24 x 48-in. table size. It permits completely automatic surface and plunge grinding to extreme repeat accuracy. Operator can direct-dial the amount of stock to be removed in increments of 0.01 to 0.0001 in. with 0.0001 in. left for finish pass before going into three pass spark-out which automatically shuts off machine.

In automatic surface grinding, the part is secured to the magnetic chuck or work surface of the machine and grinding wheel is advanced until it makes contact with the work. Then total amount of stock to be removed is preset. Rate of removal is selected and surface plunge selector is

set so automatic feed receives feed impulses at each reversal of the machine saddle. Automatic cycle is set for surface grinding and auto-feed start button is pressed to place feed mechanism in operation. In automatic plunge grinding the surface plunge selector is placed in plunge position.

Gallmeyer & Livingston Co, 400 Straight Ave SW, Grand Rapids, Mich

MORE DATA? Circle 56, inside back cover

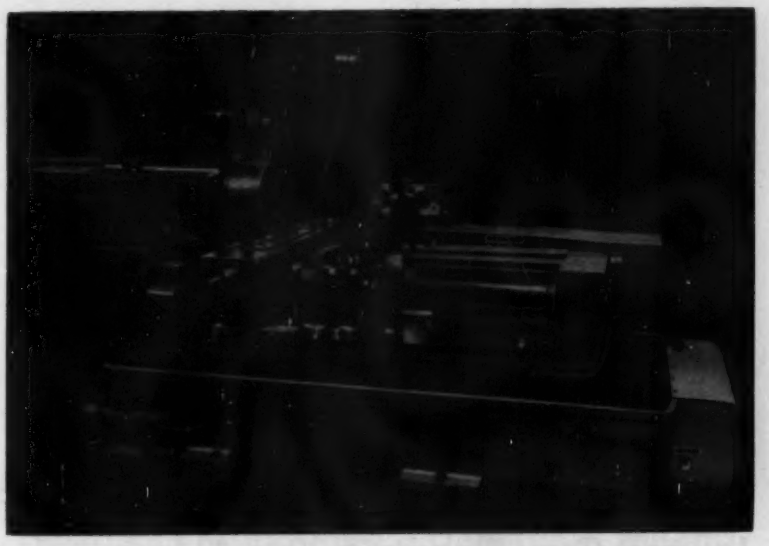
High-Density Metal Can Be Cold Worked or Formed

Mallory 3000 is a high-density metal which can be cold worked or formed and can be fabricated in a wider range of shapes than has been possible with other high-density metals.

Tests of the new metal cold rolled to a 52% reduction showed ultimate tensile strength of 195,000 psi, yield strength of 190,000 psi, and proportional limit of 90,000 psi. It is available in rolled sheets or slab 0.010 to 0.250 in. thick, 8 in. wide and 40 in. long. Swaged rod of 0.062 to 0.375 in. dia is available in lengths of 8 to 36 in.

P R Mallory & Co, Inc, 3029 E Washington St, Indianapolis 6, Ind

MORE DATA? Circle 57, inside back cover



Gisholt Introduces Automatic Ram Turret Lathe for Bar and Chucking Operations

Automatic ram turret lathe for both bar and chucking work is available in two models: the 4AR with 2 in. bar stock capacity and the 5AR with 2½ or 4½ in. bar stock capacity.

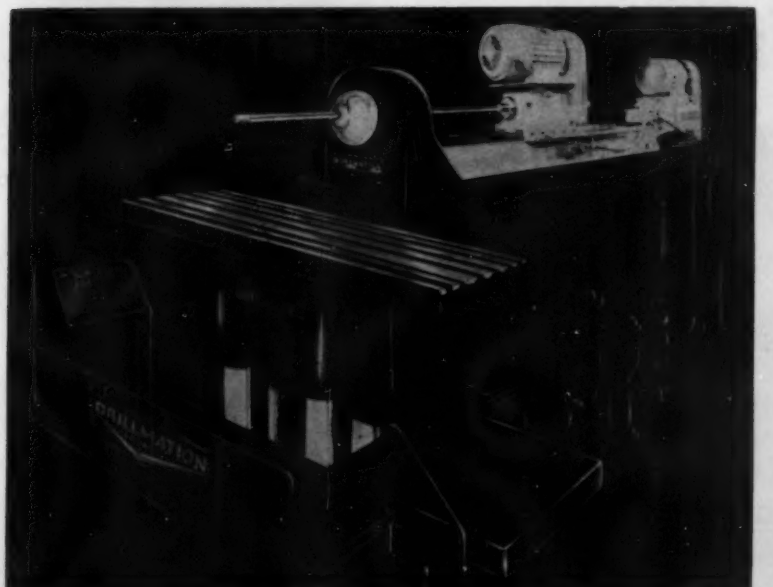
The new lathe is said to combine automatic cycle efficiency with the versatility and quick setup of the hand-operated ram type turret lathe. There are no new tool setup methods, no cams or gears to change. Except for infinite feed selection (¼ to 120 ipm) for the hexagon turret ram and the cross slide, operation is similar to manually operated lathes of the same type.

Operations that can be preset include selection of 16 spindle speeds, back feed, right or left hand threading, cross slide movement, collet chucking and bar feeding. Other special functions may also be incorporated into the automatic cycle.

A second electrical control station on the headstock includes settings for threading by die heads or taps, dwell time for each turret face and cross slide station, reverse feed for the cross slide and timing for periodic drill removal on deep hole work.

Gisholt Machine Co, Madison, Wis

MORE DATA? Circle 59, inside back cover



NUMERICALLY CONTROLLED GUN DRILLING MACHINE, called the Electra, is an automatic point-to-point and hole-to-hole tape controlled unit that can also be operated semi-automatically or manually. Power unit can drill holes up to 36 in. deep in one stroke. Either feed or spindle can be varied without affecting the other. Table measures 60 by 22 in.—*Drillmation Co, Inc, 6500 E Eleven Mile Rd, Center Line, Mich*

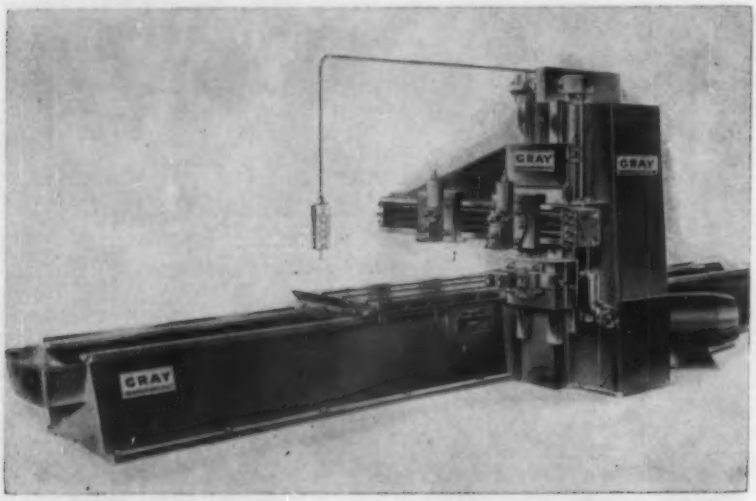
MORE DATA? Circle 58, inside back cover

Lowcost Epoxy Adhesive Bonds Sandwich Panel Components

Bondmaster M685 is a lowcost, room-temperature-curing epoxy adhesive developed for bonding rigid expanded polystyrene foams to themselves, to metal, wood and other materials. It is said to cost only ½ to 1/3 as much as similar products.

Rubber and Asbestos Corp, 225 Belleville Ave, Bloomfield, NJ

MORE DATA? Circle 60, inside back cover



Lowcost Gray Planers in 30 to 42 Inch Sizes Are Designed for Carbide Cutting

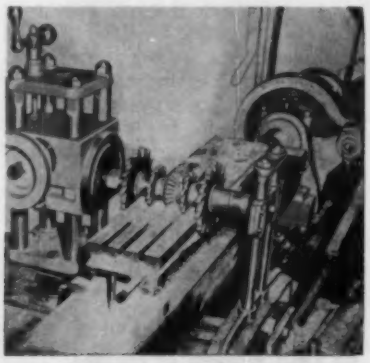
Flying Scot, said to be the first lowcost planer designed for fast carbide cutting, is available in nine combinations of table widths and heights with basic sizes of 30, 36 and 42 in.

New Helicone transmission provides a smooth, non-pulsating motion on long and short strokes. The angled helical bull gear has a minimum of three teeth in mesh with the helical rack which is set at angle to eliminate side thrust on the table.

Unit has a 60/70 hp drive designed expressly for this application. The constant torque motor, adjusted by rheostats, can be varied from 180 to 1800 rpm in both cut and return direction. Table speeds range from 30 to 300 fpm. The Flying Scot is available with single or double cutting heads. To resist the forward and reverse thrusts, the wide face on the column, rail and rail heads are all square locked.

G A Gray Co, Cincinnati 7, Ohio

MORE DATA? Circle 61, inside back cover



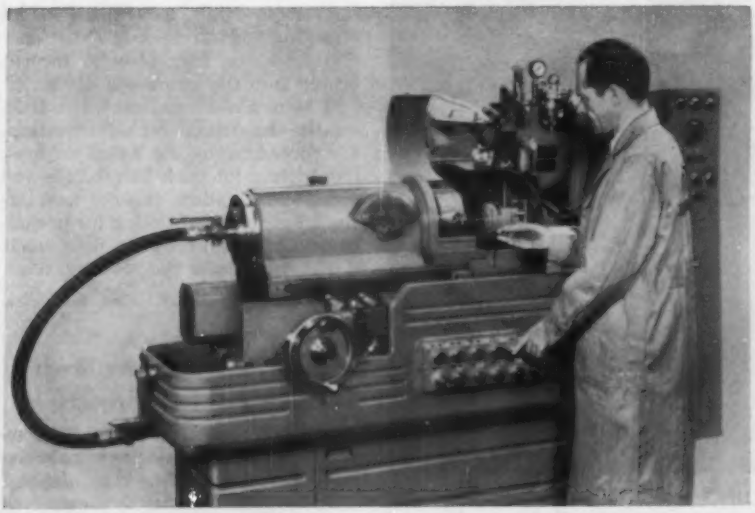
Dumore Adds Two Models To Portable Milling Equipment

Two new unit sizes have been added to company's line of equipment that can be attached to any standard machine tool for secondary operations without moving the workpiece. All Versa-Mil units can be used independently in fixtured setups because of the built-in power and feeds available.

New Model 1 for smaller work has a metal removal rate of 1/3 cu in. per minute in mild steel and can be mounted on lathes 10 in. or larger. Model 3 for large work removes metal at 1½ cu in. per min with 18 in. or larger lathe mounting. Added feature of the latter is the Outboard Arbor Support accessory which, when used with an extended arbor permits heavy straddle milling and other machining at a greater distance from the tool face.

Dumore Co, 1300 Seventeenth St, Racine, Wis

MORE DATA? Circle 63, inside back cover



INTERNAL THREAD GRINDER is equipped with two interchangeable spindles: (1) a standard Ex-Cell-O spindle designed to run at 15,000 rpm or, by changing pulleys, at speeds under or above this figure, (2) a Bryant high frequency spindle adjustable between 42,000 and 60,000 rpm—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich.*

MORE DATA? Circle 62, inside back cover

New Jiffy Disintegrator Machine Has Electro Magnetic Head

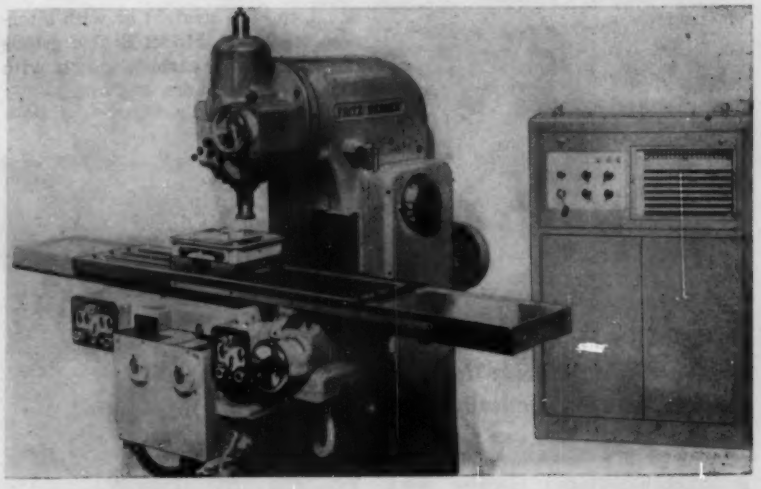
Self-contained Model C-1 added to line of machines for cutting shaped holes in hardened metals and for efficient removal of broken drills, taps, reamers, and studs, has electro mag-

netic head that travels by roller bearing carriage on double tract of radial arm with finger touch lock and movement control. In addition to the gravity automatic head feed it also has angular head adjustment through 180°.

Unit has a steel cabinet mounted on ball bearing wheels; Meehanite T-slot worktable is 25 x 30 in. and handles ½-in. T-bolts. Recessed control panel has a 5-point tap switch, power, head and pump switches, and a 0 to 100 variable autotransformer powerstat. Rating is 3.6 to 8.4 kva with a maximum output of 16 v to 550 amp. Model is furnished in 115, 220/440 v, or any special voltage.

Jiffy Disintegrators Inc, 1503 E 11 Mile Rd, Royal Oak, Mich

MORE DATA? Circle 64, inside back cover



Electrically Controlled 3-D German Milling Machine Has Pushbutton Pre-programming

Line of Fritz Werner (German) electrically controlled three dimensional milling machines is equipped with pushbutton pre-programming. It is claimed that the new control system has cut production times by 60 to 70%.

Shown is Model FV4 vertical miller with a 71 x 17-in. table and a 20-station control cabinet. Each of 15 machine functions—spindle rotation, cycle interruption, feed and rapid traverse of table saddle and knee in both directions—can be set for any of the 20 stations. Panels can be supplied with up to 80 stations.

Machine can be supplied in either vertical or horizontal models with a wide range of capacities: table sizes from 43 x 12 to 98 x 24, 18 to 21 spindle speeds from 56 to 2800 rpm to 14 to 1400 rpm, 18 to 24 feeds, 7½ to 46 hp.

Dist by Marac Machinery Corp, 108 Grand St, White Plains, NY

MORE DATA? Circle 66, inside back cover

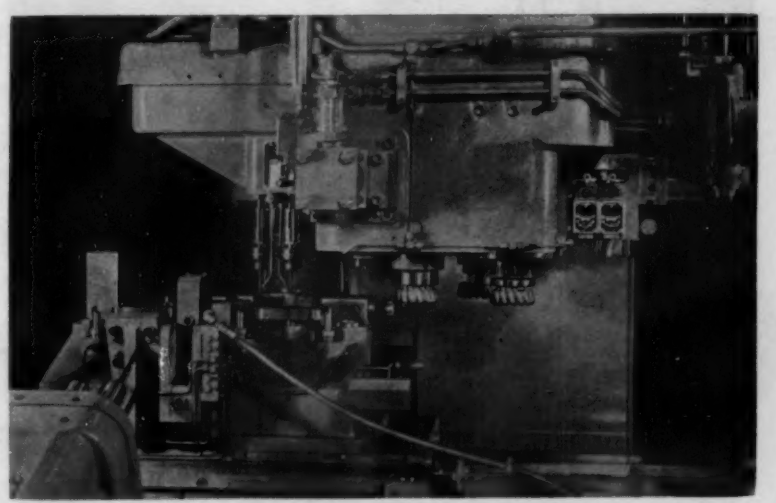
Rectangular-Shape Disc Permits Full-View Grinding Operation

Vizi-Disc is a special fiber-backed abrasive disc with two parallel straight sides with a radius at each end. As it rotates, a full inch at its outer edge becomes transparent. Resultant advantages are faster grinding through elimination of frequent inspection; reduced dwell time because grinding can be confined to exact area that requires it; complete accuracy in contour work and blending of welds. Because actual grinding is intermittent, the metal remains so cool that burning and heat distortion are said to be practically impossible.

Discs, available in 7 and 9-in. sizes, are surfaced with sharp-cutting Metalite, an aluminum oxide abrasive, in standard range of grit sizes. In use, they are supported by sisal-reinforced rubber backup pads slightly smaller than the disc. Heavy-duty pads are available for aggressive grinding.

Behr-Manning Co, Troy, NY

MORE DATA? Circle 65, inside back cover



EXHAUST MANIFOLD CASTINGS can be completely finished in this shuttle machine that mills all flange faces of manifolds while they are being transferred and does machining operations in both stations. Any change of the tailpipe flange angle can be handled by changing the fixturing and the angle of just one head in one of the stations. Production rate is 20 parts per hr at 100% efficiency—*Cross Co, Box 3835, Detroit 5, Mich*

MORE DATA? Circle 67, inside back cover

Machine Grinds Carbide-Tipped Circular Saws Automatically

Vollmer ASHK-1000 saw blade grinder, made in Germany, will grind carbide-tipped circular saws automatically. The electro-hydraulic machine is available in Model A for resharpening saws or model B for manufacturing saws.

It can handle saw blades from 5 to 40 in. dia with a maximum tooth distance of 4 in. Concentricity is 0.0002 in. According to the manufacturer, the machine will reduce grinding time by 1/3 to ½ as compared to similar units.

Both models can grind the face straight or with an alternate face bevel, the top straight or with alternate top bevel. Model B also grinds the sides of the carbide inserts with compound clearance angles.

W von Arnauld Co, 95 Grove St, Oakland, NJ

MORE DATA? Circle 68, inside back cover

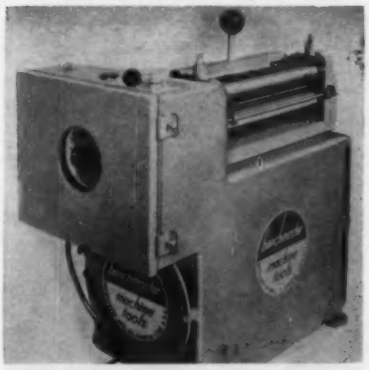
Portable Roll Spot Welder Has Speeds up to 250 ipm

Clamping pressures up to 1000 lb are attainable on this machine which is specially designed to weld three thicknesses of metal. Unit has synchronized, double-wheel, air motor drive. Spot frequency is adjustable between ½ and 1½-in. automatic spacing; two or three thicknesses of 0.032 sheet are said to be not only easily handled but present a much improved appearance.

Synchronized, special alloy drive and contact rollers, available in various diameters, turn on special, current-carrying needle bearings to withstand the high clamping pressures. Unit is accurately counterbalanced in a ring-type mounting which enables the operator to obtain universal positioning, both horizontally and vertically.

Progressive Welder & Machine Co, 915 Oakland Ave, Pontiac, Mich

MORE DATA? Circle 69, inside back cover



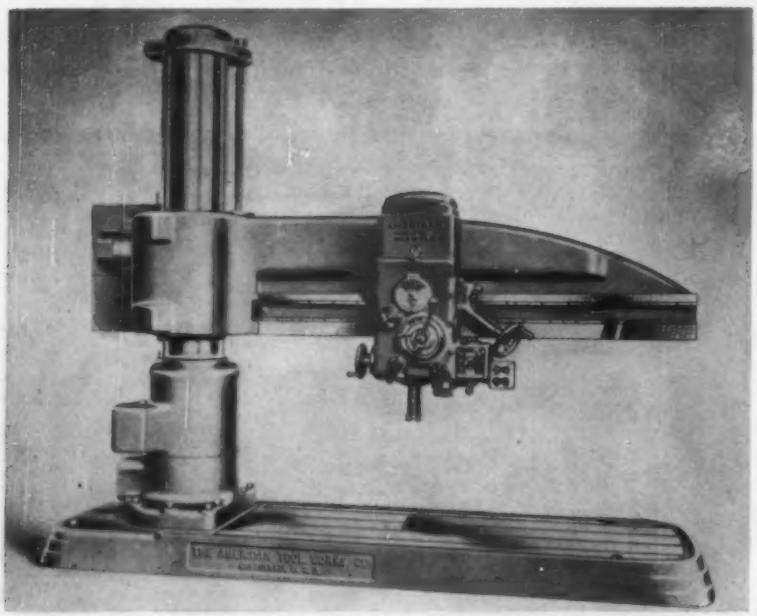
Motorized Automatic Feeder Has Instant Starts and Stops

New Benchmaster MAF automatically feeds uniform, predetermined lengths of material to any secondary machine. It consists of a friction type roll feed mechanism driven by a constantly running electric motor-driven flywheel. Solenoid-operated clutch-brake unit instantly engages the rolls or stops roll motion upon disengagement. Adjustable length measuring control can be preset to continuously and automatically produce any work length within the machine's range from 3 to 60 in. Micrometer control permits work length adjustments to 1/32 in. or less. Standard feed speed is 50 sfm; other feed length ranges and speeds can be supplied. Machine can be manually tripped or made to cycle automatically with any machine motion. Portable trip switch and 12-ft cord are provided for this function.

Available in several models, the machines handle stock up to 12 in. wide and to ⅛ in. in thickness. They can be used to feed flat material, coiled stock, or even round stock with specially contoured rolls.

Benchmaster Mfg Co, 1835 W Rosecrans Ave, Gardena, Calif

MORE DATA? Circle 71, inside back cover

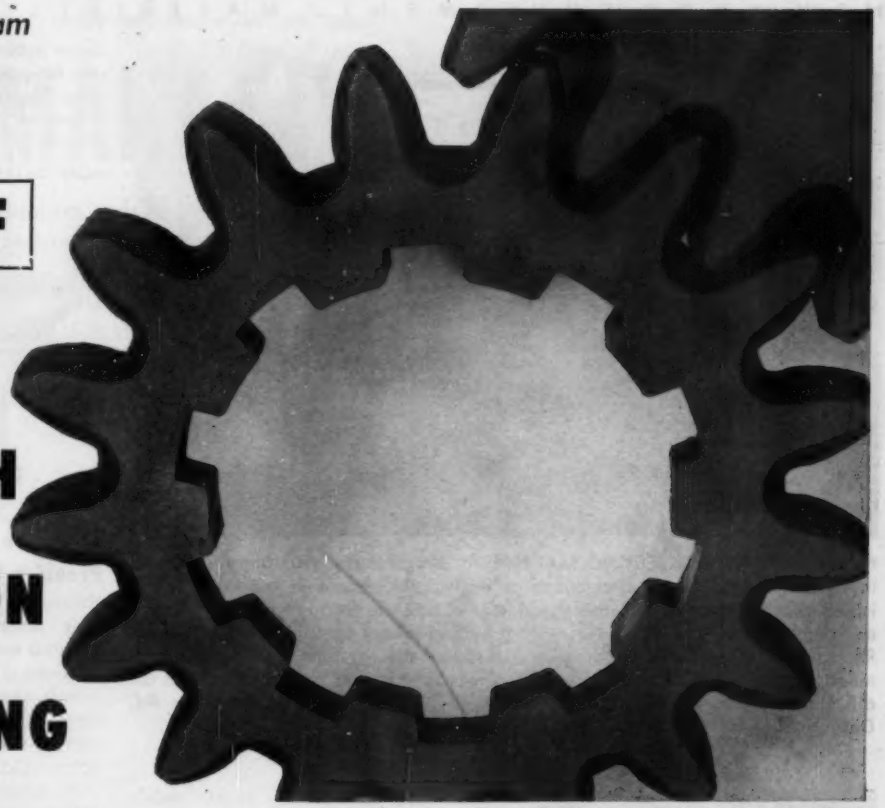


MAXI-SPEED HOLE WIZARD RADIAL DRILL for medium applications is available in column sizes from 13 through 19 in. in dia with arms from 5 to 14 ft in length. Holes up to 2 in. in dia can be drilled and tapped in steel. In addition to manual feeds, head provides 12 spindle speeds with three optional ranges, plus six power feeds with two optional ranges. (AM—Jun 1 59, p150) —*American Tool Works Co, Pearl St at Eggleston Ave, Cincinnati 2, Ohio*

MORE DATA? Circle 70, inside back cover

at Farrel-Birmingham

NEW S&F TOOTH-TO-TOOTH INDUCTION HARDENING



Typical hardening pattern along flanks and through root.

...produces toughest gears yet!

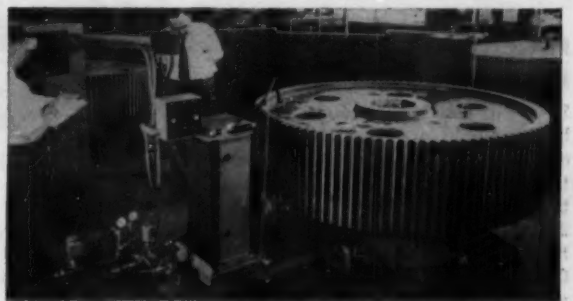
There's nothing like the S & F method of tooth-to-tooth gear hardening. Not only does it add amazing durability to big gears, but load-carrying capacity is vastly increased. Warpage can be insignificant depending on gear design. And there can be substantial savings in material and machining costs!

Farrel-Birmingham tells us that in one installation large gears with S & F induction-hardened teeth have already gone through over two years of rugged service with absolutely no sign of wear—whereas formerly, gears had to be *replaced* every two years. Reports of other installations are also highly satisfactory.

Precision controls maintain constantly accurate time, current, feed and distance between coil and workpiece to assure consistent results. In a group of similar gears, all portions of all teeth will have the same predetermined case contour and depth of hardness. In fact, hardening depth is so accurately controlled and warpage so minute that, for a number of gears, no additional machining is required.

S & F induction hardening units capable of handling gears from 3 in. to 20 ft. in diameter and larger, are available in semi-automatic and automatic models.

Want to know how this revolutionary approach to gear hardening can fit your production? Just ask us about it.



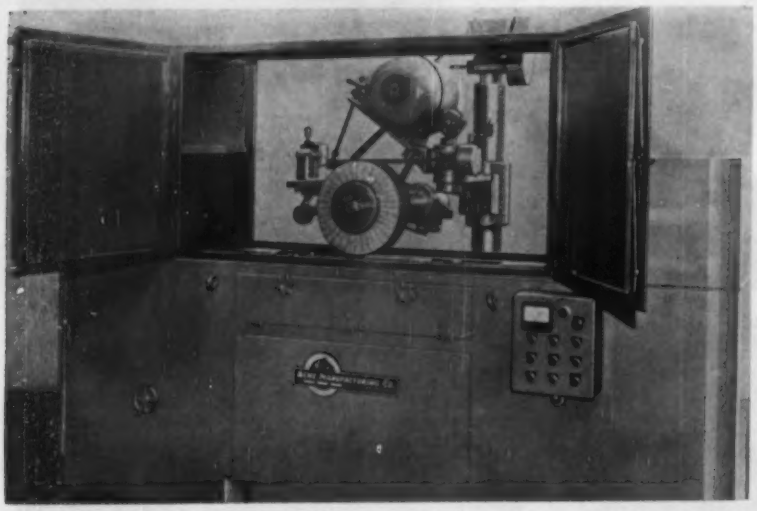
Spur, helical and double helical gears up to 157 in. diameter and 20 in. face widths are induction hardened tooth-by-tooth in this S & F equipment at Farrel-Birmingham, Ansonia, Conn.

KO CO., INC. PRECISION MACHINERY

KURT ORBAN

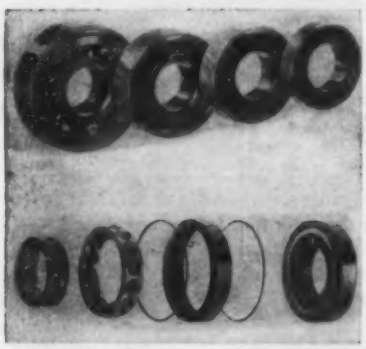
COMPANY, INC.

36 Exchange Place, Jersey City 2, New Jersey



FINISHING PROCESS TESTING MACHINE is designed for evaluating variables in equipment, tools, and compounds as well as differences in base metal finishing characteristics. With the machine it is possible to have conditions such as sample feed, buffing pressure, and buffing wheel speed varied for tests. Readings of motor horsepower, plus a study of the resulting finish, provide a means of evaluating the variables in process speeds and pressures as well as differences in wheels and compounds—*Acme Mfg Co, 1400 E Nine Mile Rd, Detroit 20, Mich*

MORE DATA? Circle 72, inside back cover



Precision Ball Bearings Have Increased Load Capacity

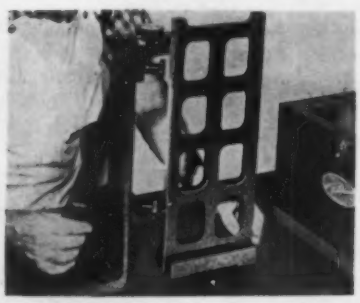
Heavy-duty HDR radial precision ball bearings are said to have load capacities from 19 to 55% greater than equivalent size Conrad type bearings and life expectancy up to 298% greater. They are also said to have 20% less radial deflection than Conrad types and have two to six more balls per bearing.

In making the bearings, the outer ring is fractured at one point and spreads to permit the maximum complement of balls. Full depth symmetrical raceways with no loading slots permit HDR bearings to carry thrust loads from either direction.

Offered in ABEC-3 and ABEC-5 precision grades, the bearings are made in extremely light, extra light, light and medium series in sizes up to 85 mm OD.

Split Ballbearing Div of MPB, Inc, Lebanon, NH

MORE DATA? Circle 73, inside back cover



New Robbins Indicator Gage Checks 90° Work Angles

Instrument can also be used in conjunction with Robbins angular sine plates to check precision of angles other than 90°. In addition, such items as mounted die details can be checked for relative position by using gage blocks in combination with the indicator gage. It is furnished complete with dial indicator, master square, and hardwood box.

Dial gage has standard AGA mounting and instantly registers plus or minus errors in work to one ten thousandth of an inch. Distance between the two contact points can be quickly changed over a range from 1⅛ to 17¾ in.

Omer E Robbins Co, 11916 Dixie Ave, Detroit 39, Mich

MORE DATA? Circle 74, inside back cover

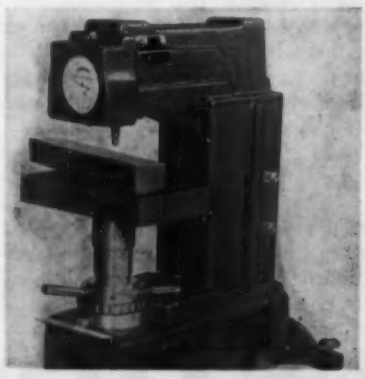
Miniature Turret Indexing Unit Provides Intermittent Motion

Swanson Series J, designed to provide intermittent motion for high volume assembly and processing operations, is built for semi-automatic bench operations or for use as a small automatic machine chassis. It can also be used as an auxiliary turret on larger automatic machines.

Standard unit has a 12-in.-dia turret, eight work stations, and an index to dwell relationship of 1:1 (180° index). Fully mechanical, it uses a hardened steel cross-over indexing cam that provides cycloidal displacement. Series J incorporates drive motor, reduction unit, and main cam shaft extension for mounting tool actuating cams. Power is provided by a ¼-hp electric motor.

Swanson-Erie Corp, 814 E Eighth St, Erie, Penna

MORE DATA? Circle 75, inside back cover



MOTORIZED HARDNESS TESTER which automatically removes major testing loads provides greater testing consistency—*Torsion Balance Co, Clifton, NJ*

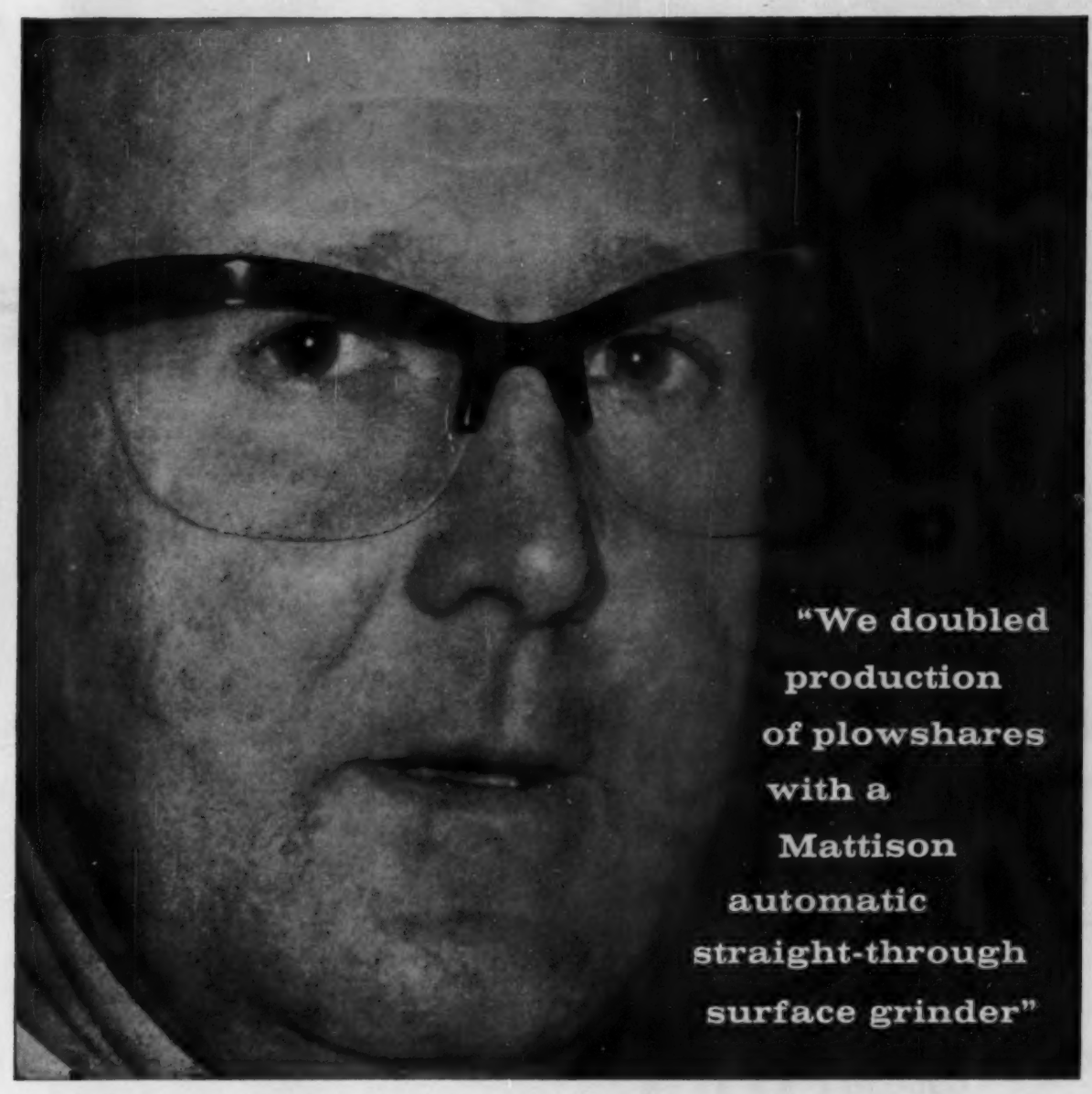
MORE DATA? Circle 76, inside back cover

John Deere Plow Works, Moline, Ill., has been a leading manufacturer of plows since 1837

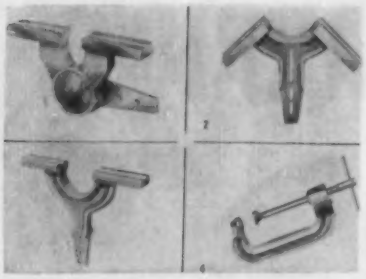
SALES MANAGER MARRIOTT

"Our program to double production, reduce costs, and increase product values, all pointed to one answer—automation. The Mattison recirculating pallet-type surface grinder fills the bill admirably on all three counts," says George Marriott, sales manager, John Deere Plow Works. Because grinding wheels are self-sharpening, automatic straight-through, round-the-table, or planetary head surface grinders offer you a choice of precision machining methods that avoid downtime associated with other processes.

MATTISON MACHINE WORKS
ROCKFORD, ILLINOIS



CIRCLE 249 READER SERVICE CARD



Line of Workholders and Clamps Offered for Short-Run Joining

New line is designed for positioning and holding pipes, rods, tubes, plate, bars, and other structurals in short-run welding, soldering, and brazing. They include (1) *adjustable*—clamping faces can be set at any angle from zero to 180° by calibrated dial and single, quick-lock handle; (2) *right angle*—clamping faces permanently fixed at exact 90° angle for all types of right angle joining; (3) *straight*—with clamping faces aligned to inline butt joints. Two holders can be locked into position for T-joints. (4) *Standard and quick acting clamps*—in 4 and 6-in. capacities, standard only in 3 in. Quick acting types have trigger for setting or releasing.

All of the holders can be combined to make almost any pattern of 2 or 3-way joints and these combinations can be arranged to provide jig-type setups.

Wales-Strippit Inc, 800 S Buell Rd, Akron, NY

MORE DATA? Circle 77, inside back cover

Squirrel Cage Induction Motors Offered in New High Speed Line

Motors are available in 100-5000 hp, 514-3600 rpm, frames 584-11320. Features include one piece, wrap-around steel plate cover running full length of the frame and extending well below the center line on each side to provide drip-proof protection and increased rigidity; double end ventilation system; stainless steel retaining rings over rotor end assemblies to give additional protection against stresses from centrifugal force where high peripheral speed is encountered. Critical speeds are maintained well above operating range to insure smooth, vibration free operation. Motors, supplied with oil lubricated bearing, are available with silicone rubber as well as class A, B, and H insulations.

Ideal Electric & Mfg Co, Mansfield 86, Ohio

MORE DATA? Circle 78, inside back cover

Hayes Offers Compact Induction Heating Unit

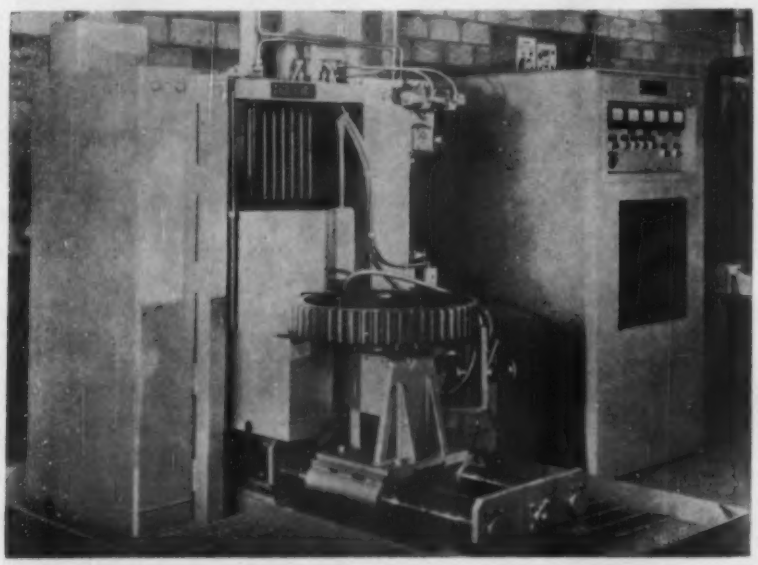
High-speed induction heating unit can be used for selective hardening, tempering and annealing of tool steel parts, and for other heating and bonding applications.

Both heater stations and power generator are incorporated in a single console. Push-button control permits non-technical operators to obtain exact surface heating patterns without distortion, decarburization or excessive oxidation.

The 30-kw unit is 5 ft wide, 3 ft deep, 6 ft 9 in. high. It is also available in 5, 10, 20, and 60 kw capacities.

C I Hayes, Inc, Wellington Ave, Cranston, RI

MORE DATA? Circle 79, inside back cover



TOOTH BY TOOTH GEAR HARDENING MACHINE for 6 to 60-in.-dia and 1 to 5-DP gears features complete automatic indexing and scanning and a pedestal with two hub adapters, adjustable with leadscrew and crank. Improved unit is now completely hydraulic with temperature compensated scan speed control valves. Cam bars for length of stroke and control of heat and quench are mounted on the front for greater convenience—*Ajax Magnethermic Corp, Youngstown, Ohio* MORE DATA? Circle 80, inside back cover

Resurfacing Compound Said to Be Six Times Stronger Than Concrete

RIW Epo-Tox is a highly adhesive, epoxy-type floor patching and resurfacing compound which may be applied in layers as thin as ⅛ of an inch. It eliminates need for chipping, jack-hammering, and other preparation normally associated with concrete floor repair work.

Features include no shrinking of patch or topping; can be applied in any required thickness or thinness without loss of impact and abrasion resistance; protects against most industrial acids, alkalies, and solvents; quick-setting (floors can be returned

4-col. presses bristle with production-boosting features

KRW has done it again! This time, the 25-1000 ton KRW line of 4-column, single action hydraulic presses has been modernized to set a new pace over a broad work range.

Bristling with newness, these smooth-acting machines are built to outperform even KRW's highly regarded, prior designs in a wide variety of assignments: Blanking, forming, punching, trimming, drawing, extruding, briquetting, straightening, pressure clamping, laminating and bonding.

Already acclaimed "a marked success," KRW's latest version of the 4-column press boasts numerous features to improve quality and increase productivity: Of rugged, welded steel construction, the crown, bed and sliding platen provide maximum resistance to deflection. Align-bored to automatically controlled tolerances, the sliding platen is guided on ground and polished columns which are closely fitted into the crown and bed.

Easy to adjust, KRW hydraulic systems assure instant, complete press control. Compactly designed, the pumping unit can be mounted at the top of the press or furnished for floor installation.

Available with either up-acting or down-acting platens, KRW 4-Column Presses can be outfitted with manual lever or electric push buttons for single or continuous cycling.

For detailed information and specifications, write for Bulletin 95-D. K. R. Wilson, Inc., 212 Main St., Arcade, N. Y.

KRW HYDRAULIC PRESSES

CIRCLE 250 READER SERVICE CARD

to normal use after overnight curing). Available in gray, red, or green for indoor or outdoor application by trowel or other working tool.

Tock Brothers, Staten Island, NY

MORE DATA? Circle 81, inside back cover

Improved Electric Steam Cleaner Provides Triple Cleaning Action

Speedylectric Hydro Steam-Jet Cleaner, Model MHYD, which can be supplied for use with 220/440 or 550-v 3-phase electric current, operates with a single hose and heavy-duty swivel steam gun. It can be used as a high-pressure steam cleaner, with or without detergents, or quickly switched to a high-pressure hot or cold rinse unit, or a dry steam cleaner where excessive water is objectionable.

Once the unit has been switched on, it can be held at full operating pressure all day, ready for instant use. Steam-jet can be shut off or cut down by the operator at the gun. Any grade of steam cleaning detergent can be used; it is fed from a built-in detergent tank with agitator and heater.

Pan-Tex Mfg Corp, PO Box 660, Pawtucket, RI

MORE DATA? Circle 82, inside back cover

Branson Introduces Cleaning Unit That is Fully Transistorized

Self-contained ultrasonic cleaner, Model LGT-40, is designed for removing a variety of soils and contaminants from precision parts, electronic components, sub-assemblies, and similar items. An on-off switch is the only generator control required; second switch controls integral heating elements to keep the cleaning solution at proper temperature.

Both housing and inner tank are of 300 series stainless. The ½-gal tank is completely removable to simplify drainage of spent cleaning solution. Generator output is 40 w average, 80 w on peaks. Power input is 120 w at 115 v, 50/60 c ac. Unit is 14 in. deep, 7 in. wide, and 13 in. at its highest point. Countertop (working) area is 10 in. above the table. Model may be ordered with or without integral heater.

Branson Ultrasonic Corp, 40 Brown House Rd, Stamford, Conn

MORE DATA? Circle 83, inside back cover

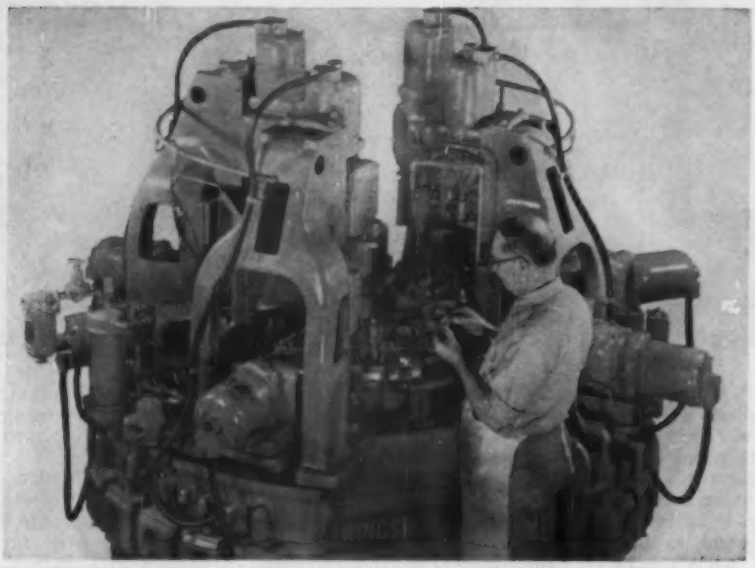
Radiant-Fired Melting Furnace For Use With Aluminum Diecasters

Model RSHCH is reported to have superior qualities for production of low porosity aluminum castings. Kozma Pre-Temp charging and subsurface metal flow principles of design are said to virtually eliminate hydrogen pick-up and oxide inclusions, keeping metal at an extremely high purity level.

Pre-Temp charging knee with its specially designed position angle prevents the ingot from entering the bath until it has reached a plastic state. Pre-heating of the ingot is approximately 70% of the melting point at which heat the ingot deforms and is allowed to slide into the bath with little or no increase in surface area. In order to further insure metal purity, zone dividing walls extend below surface of the bath eliminating transfer of surface oxide film to the dipwell. Radiant panel firing provides fast, uniform heat distribution, eliminates flame impingement, and reduces overall fuel costs (approx 1000 Btu per lb).

J A Kozma Co, 2471 Wyoming, Dearborn, Mich

MORE DATA? Circle 85, inside back cover



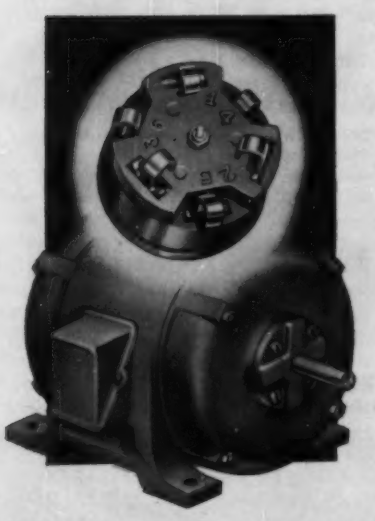
MULTI-UNIT AUTOMATIC performs 18 operations on motor supports for electric shavers. Eleven units drill, ream, and tap at a gross rate of 1000 parts per hr. A 24-in. index table holds eight work fixtures that are clamped and unclamped while indexing by means of a cam mounted on the center stud—*Kingsbury Machine Tool Corp, Keene, NH*

MORE DATA? Circle 84, inside back cover

FISHING

for a Way to STOP MOTOR BURNOUTS ?

Specify and Use 3-Phase Motors with KLIXON® PROTECTORS



Here's How You Benefit: ● *Eliminate motor burnouts* ● *Get safe maximum motor output* ● *Reduce motor repairs and replacements* ● *Reduce costly equipment down time.*

Motor burnouts are always a problem. They slow production, idle workers (except the repair crew) and are costly.

You can practically eliminate motor burnouts in your equipment and replacement motors by using motors with KLIXON Protectors.

Built-in by the motor manufacturers, KLIXON Protectors safeguard and protect motors from burning out under the following conditions . . . prolonged overloads, unbalanced voltage, stalling, failure to start, increased ambient temperatures, lack of ventilation, plugging, or reversing duty, and single phasing.

And remember, get the same complete protection in your single phase motors, too.

KLIXON protected motors are available from your motor supplier. The additional cost is low, the savings great. Ask your motor supplier for KLIXON protected motors.

Write for a free copy of Bulletin PR-1243. It gives the complete story.

TEXAS INSTRUMENTS
INCORPORATED
METALS & CONTROLS DIVISION
5604 FOREST STREET • ATTLEBORO, MASS.

SPENCER PRODUCTS

Spencer Products: Klixon® Inherent Overheat Motor Protectors • Motor Starting Relays • Thermostats • Precision Switches • Circuit Breakers

8-SPINDLE BORING MACHINE uses standard machine slides and other building block components to machine aluminum alloy V-12 engine crankcase. During the cycle a total of 37 individual cutting operations are performed—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich*

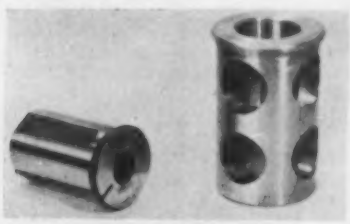
MORE DATA? Circle 86, inside back cover

Pneumatic Bender Has ½-Inch Steel Capacity

B-10 series pneumatic bender can bend up to ½-in. steel rod or four ¼-in. steel rods stacked. It can bend any shape in one second and takes only minutes to set up. Bends up to 135° can be made. It also has a 15-in. working table, 1½-in. die height and operates on 100 lbs air pressure.

W V Industries, Box 222, Hawthorne, NJ

MORE DATA? Circle 87, inside back cover

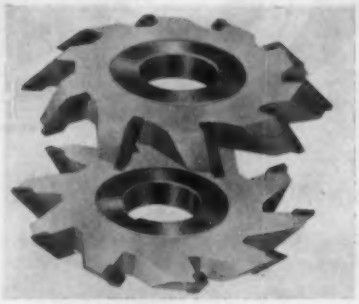


New Toolholder Bushings Offered For Turret Lathes and Automatics

Hardened and ground bushings, available in both solid and split types, adapt cutting tools to turrets and tool slides of turret lathes and automatics. They are reported to hold their shape, retain accuracy, take rough punishment, and still cost less than soft bushings. Split bushings are stocked in bore sizes from ⅛ to 3 in. The ODs range from ¾ to 3½ in. and lengths from 1¾ to 5¼ in. Solid bushings come in similar sizes.

Gahr Machine Co, 19199 St Clair Ave, Cleveland 19, Ohio

MORE DATA? Circle 88, inside back cover



Carbide-Tipped Angular Cutters Mill Angular Grooves, Dovetails

New Nelco 45° cutter has generous carbide tips to facilitate regrinding without grinding steel cutter body. Available with two carbide grades, the Series 200 is recommended for steel and Series 300 for cast iron, brass, bronze, and similar non-ferrous materials.

Designed for use on arbor, the teeth have 0° rake and the cutter may be ordered with keyway in line with teeth or halfway between teeth for interlocking or ganging with Nelco carbide-tipped side mills, slab mills, and saws for multiple milling operations. Chamfer on outer diameter is 1/64 in. maximum and tolerances are ±0.015 on cutter diameter and width. Cutter is available in three sizes from 4 to 6-in. dia and either LH or RH. The 4-in. tools have 10 teeth.

Brown & Sharpe Mfg Co, Cutting Tool Div, Providence 1, RI

MORE DATA? Circle 89, inside back cover

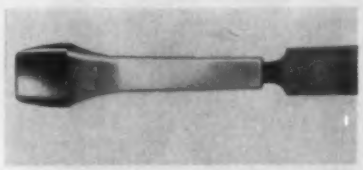
Rotary Index Tables Feature Slow Start and Slow Stop

New line is powered by either a fractional horsepower electric motor, rotary air motor, or hydraulic motor. Locking and indexing construction, however, is entirely mechanical. A 40:1 ratio on a worm gear drive rotates a cam, giving positive accurate lock on 180° of the rotation and smooth turning motion on the other 180°. Crank drive from the cam activates an indexing pawl to give the slow start and slow stop motion of the worktable during the turning cycle. Indexing can be up to 5000 per hr with relatively heavy fixture loads.

Steel table top rotates on a high tensile iron base; all wearing parts have anti-friction bearings. Unit is available with 10 or 18-in.-dia table top and choice of station requirements.

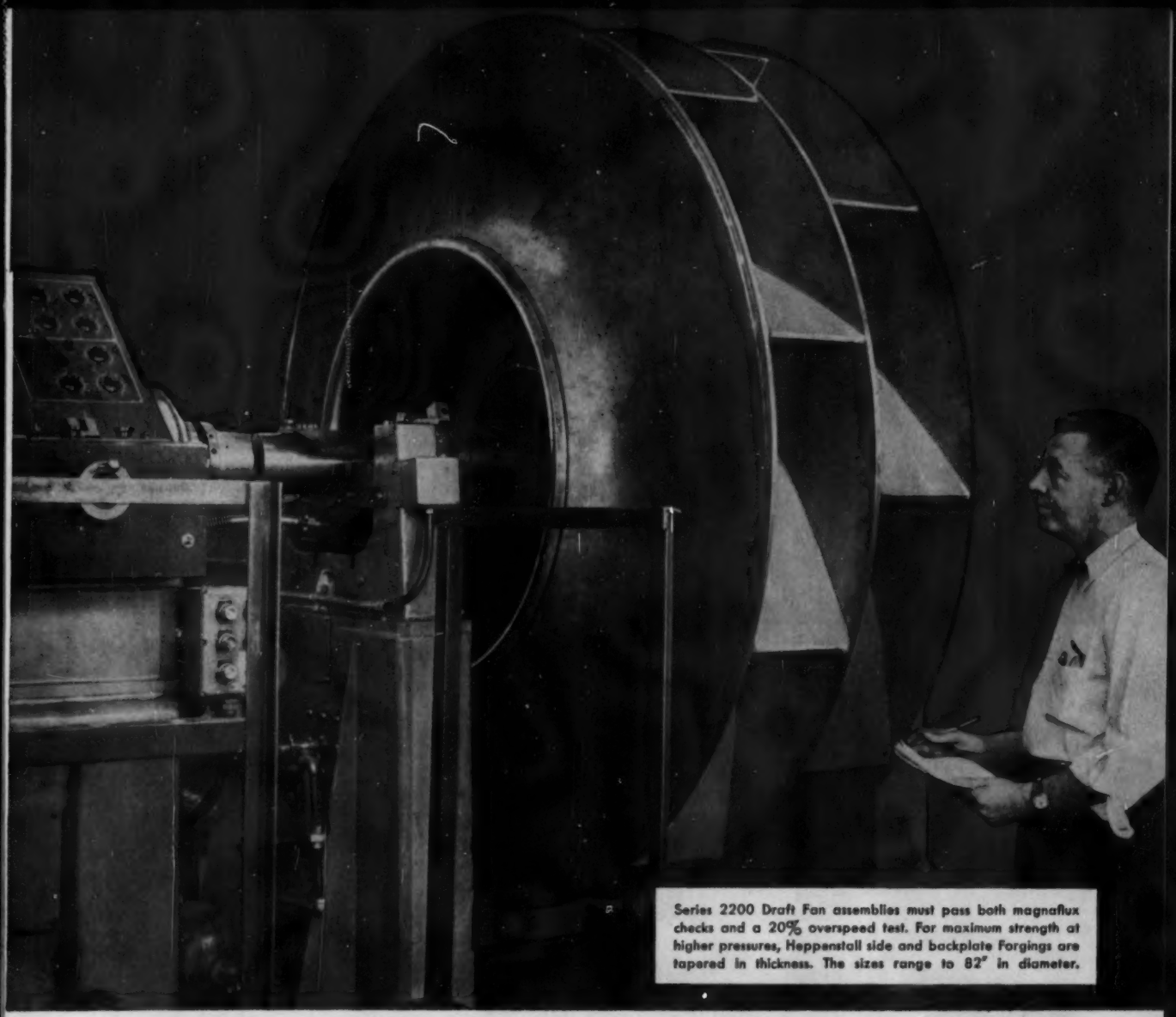
Jackson Fluid Power Co, 16722 E Warren Ave, Detroit 24, Mich

MORE DATA? Circle 90, inside back cover



FILE HANDLES, made of high impact thermoplastics, are square in section to prevent rolling on bench when attached to round or tapered file—*Danielson Mfg Co, Subsidiary of Nicholson File Co, Danielson, Conn*

MORE DATA? Circle 91, inside back cover



Series 2200 Draft Fan assemblies must pass both magnaflux checks and a 20% overspeed test. For maximum strength at higher pressures, Heppenstall side and backplate Forgings are tapered in thickness. The sizes range to 82" in diameter.

To be sure...

Westinghouse uses Heppenstall Forgings for its Series 2200 Mechanical Draft Fans

"We use Heppenstall Forgings for our Series 2200 . . . the forgings machine well and stand up under the various processes that we subject them to in preparing them to our specifications. When you combine quality with reliability . . . it answers our desires." So says Mr. J. E. McDonald, Manager of Engineering, Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Massachusetts.

In the series 2200, Heppenstall Forgings are used for the side plate, center plate with hub, back plate and fan shaft. This is the first fan ever to provide the advantages of "airfoil" blading to single stage blowers in a range of pressures from 45" to 90" of water, at motor speeds of 1800 RPM.

Heppenstall Forgings, in any shape you may require, are made from special Heppenstall open hearth carbon and alloy steels, or high alloy and heat resisting stainless steels from Heppenstall Electric Induction Furnaces. Before shipment, each forging passes rigid inspection and ultrasonic testing. This assures you a trouble-free component of your product.

Find out how Heppenstall Forgings can build extra quality and performance into your equipment. Ask your Heppenstall Company Representative.

HEPPENSTALL COMPANY
PITTSBURGH 1, PENNSYLVANIA
Plants: Pittsburgh, Pa. • Bridgeport, Conn. • New Brighton, Pa.

MIDVALE-HEPPENSTALL COMPANY
NICETOWN, PHILADELPHIA 40, PA.

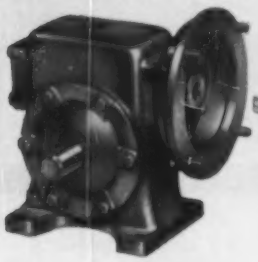
Die Blocks • Forgings • Back-Up Roll Sleeves • Rings • Industrial Knives • Materials Handling Equipment
Pressure Vessels • Hardened and Ground Steel Rolls • Vacuum and Consumable Electrode Melted Steels

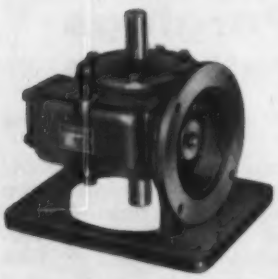
956

different
motorized
speed reducers

available from stock

Yes! 956 different combinations of Perfection Motorized Worm Gear Speed Reducers are available for immediate delivery, *from stock.* Ratios range from 5 to 1 to 60 to 1, in capacities from 1/6 H.P. to 5 H.P. Perfection "C" Flange Reducers may be ordered complete with motor or without motor, to be used with a motor *of your own choice.*





Flanged motor reducers offer the maximum in compactness, rigidity and adaptability. Through the use of standard NEMA face mounted motors, complete interchangeability between motors is provided. Motor maintenance is possible without disturbing the drive and reducer. Motor assembly is fast and positive with no alignment problems.

Write for your free copy of our new 28 page catalog containing illustrations, charts and tables to help you choose the right Reducer for your particular application. Ask for Bulletin No. M-140.

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AMERICAN STOCK GEAR DIVISION
PERFECTION GEAR COMPANY, HARVEY, ILLINOIS

NEW SHOP EQUIPMENT

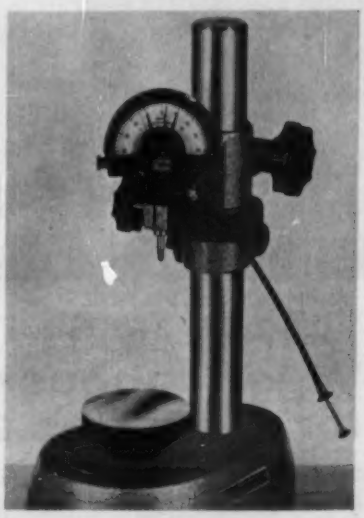
New Sioux Air Chisel Offered by Albertson

Sioux Slugger is designed to shear or cut metal, cut or drive rivets, scrape metal, break welds, punch sheet metal holes, split nuts, shear bolts, pull pins, drive bearing races and pressed bearings, crimp sheet metal making a strong, neat joint.

Features include a one-piece barrel without parts to wear, and a cast iron handle. Tool is priced at $85. Kit including seven attachments in a metal case is available.

Albertson & Co, Sioux City, Iowa

MORE DATA? Circle 92, inside back cover



New Mauser Dial Indicators Introduced by Scherr-Tumico

Two models are available—one has direct reading in 0.0005 in. with a full range of dial of 0.004 in. and 20-0-20 graduations; the other has direct readings in 0.0005 in., 0.016 in. full dial range, and 8-0-8 graduations. The former (cat. 658) is priced at $32.50, the latter (cat. 657) sells for $16.

New Mauser indicator stand has a 6-in. capacity with a 2½-in.-dia hardened, ground and lapped steel table

BATH *Tap'n Gage* TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 15

Subject: Tap Drill Sizes

To avoid tapping difficulties, it is advantageous to keep the minor diameter of the tapped hole as large as possible to utilize the lowest percentage of full thread consistent with adequate strength.

A minor diameter that provides a 55% to 65% thread is sufficient in most tapped hole requirements, but in some specific cases a higher percentage of thread may be necessary.

In most materials and under ideal conditions drills may be expected to cut oversize. In the table at the bottom of the page, the probable percentages of full thread were determined by the average amount oversize the various drills are expected to cut. Reaming becomes necessary when closer control of the hole size is required.

SUGGESTED PERCENTAGES OF FULL THREAD IN TAPPED HOLES

MATERIAL		DEEP HOLE TAPPING	AVERAGE COMMERCIAL WORK	THIN SHEET STOCK OR STAMPINGS
Hard or Tough	Cast Steel Drop Forging Monel Metal Nickel Steel Stainless Steel	55%-65%	60%-70%	
Free Cutting	Aluminum Brass Bronze Cast Iron Copper Mild Steel Tool Steel	60%-70%	65%-75%	75%-85%

PROBABLE PERCENTAGE OF FULL THREAD PRODUCED IN TAPPED HOLE USING STOCK SIZES OF DRILL

TAP	TAP DRILL	PERCENTAGE OF THREAD
0-80	56	74
	3/64	71
1-64	54	81
	53	59
1-72	53	67
	1/16	50
2-56	51	74
	50	62
	49	49
2-64	50	70
	49	56
3-48	48	78
	5/64	70
	47	69
	46	60
	45	56
3-56	46	69
	45	65
	44	48
4-40	44	74
	43	65
	42	51
	3/32	50
4-48	42	61
	3/32	60
	41	52
5-40	40	76
	39	71
	38	65
	37	58
5-44	38	72
	37	63
5-44	36	55
6-32	37	78
	36	71
	7/64	64
	35	63
	34	60
	33	55
6-40	34	75
	33	69
	32	60
8-32	29	62
	28	51
8-36	29	70
	28	57
	9/64	57
10-24	27	79
	26	74
	25	69
	24	64
	23	61
	5/32	56
	22	55
10-32	5/32	75
	22	73
	21	68
	20	64
	19	51
12-24	11/64	75
	17	73
	16	66
	15	60
	14	56
12-28	16	77
	15	70
	14	66
	13	59
	3/16	54
1/4-20	9	77
	8	73
	7	70
	13/64	66
	6	65
	5	63
	4	57
1/4-28	3	72
	7/32	59
	2	55
5/16-18	F	72
	G	66
	17/64	59
	H	59
5/16-24	H	78
	I	67
	J	58
3/8-16	5/16	72
	O	68
	P	59
3/8-24	21/64	79
	Q	71
	R	58
7/16-14	T	81
	23/64	79
	U	70
	3/8	62
7/16-14	V	60
7/16-20	W	72
	25/64	65
	X	55
1/2-13	27/64	73
	7/16	58
1/2-20	29/64	65
9/16-12	15/32	82
	31/64	68
9/16-18	1/2	80
	33/64	58
5/8-11	17/32	75
	35/64	62
5/8-18	9/16	80
	37/64	58
3/4-10	41/64	80
	21/32	68
3/4-16	11/16	71
7/8- 9	49/64	72
	25/32	61
7/8-14	51/64	79
	13/16	62
1- 8	57/64	83
	7/8	73
	59/64	64
	29/32	54
1-12	29/32	81
	59/64	67
	15/16	52
1-14	59/64	78
	15/16	61

• Cylindrical and Thread Gages • Ground Thread Taps • Internal Micrometers John BATH & Co., Inc.
22 Mann Street, Worcester, Mass.

CHICAGO® PRESS BRAKES

unexcelled accuracy / ***for sheet metal and plate work***

Model 410D, 90-Ton CHICAGO Mechanical Press Brake. Other standard sizes from 11 to 450 ton capacities.

Model 600H10, 600-Ton CHICAGO Hydraulic Press Brake. Other standard sizes from 300 to 2000 ton capacities.

Complete details or recommendations on any press brake work upon request

Press Brakes
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Special Forming Machines

CHICAGO DREIS & KRUMP

DREIS & KRUMP MANUFACTURING CO.
7434 S. Loomis Blvd., Chicago 36, Illinois

specially shaped to accommodate odd pieces. Its over-all height is 10½ in. and it will take all dial indicators with 8-mm shank. Price is $29.75.

Scherr-Tumico, 200 Lafayette St, New York 12, NY

MORE DATA? Circle 93, inside back cover

Micrometer Gage Locates Beveled or Rectangular Grooves

Micrometer gage is designed to measure the distance from the outer wall of a beveled or rectangular retaining ring groove to a plane of reference located 0.4 to 1.4 in. from the groove wall.

The gage can be used to measure the location of O-ring grooves, rectangular oil grooves, thread reliefs and other internal recesses in bores and housings and external grooves on shafts and similar parts. It will measure grooves in housings or shafts 1½ in. dia or larger.

A removable flange included with the gage can be attached to the spindle to provide an artificial reference shoulder if there is none on the part. The flange is also useful for measuring distances between two grooves and to measure groove width. Price is $42.50.

Truarc Retaining Rings Div of Waldes Kohinoor, Inc, 47-16 Austel Pl, LIC 1, NY

MORE DATA? Circle 94, inside back cover

"Now then—if you'll just show me where you want this delicate device—"

Supreme

in cutting high temperature alloys,
ultra high strength alloys, special and rare metals

broaching
milling
hobbing
turning
drilling
planing

VASCO SUPREME®

Vasco Supreme is being used successfully for machining the special metals and alloys here listed*—often when other cutting tool materials, including carbides, have failed. • In addition, of course, Vasco Supreme delivers outstanding performance throughout industry in machining heat-treated steels of standard compositions, and hard and abrasive materials such as cast iron, cast steel, aluminum and plastics, etc. • Whatever the areas of your difficult cutting assignments, specify unique Vasco Supreme for performance surpassing by many times that of any other high speed steel. Let us counsel you on latest applications techniques.

**All applications are supported by successful performance reports on file.*

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FIRST QUALITY TOOL & SPECIAL STEELS V/A

Our 50th Anniversary

Vanadium-Alloys Steel Company
LATROBE, PENNSYLVANIA

AMERICAN

Please

American Twist Drills are not readily available—The American Automotive Industry demands practically all capacity for precise, uniform mass production requirements. Eventually they will be available to all industry through selected Industrial Distributors.

'60

Booth Nos. 842 & 1131

Brown & Sharpe CUTTING TOOLS

American Twist Drill Co.
Detroit, Michigan
Subsidiary of
Cutting Tool Division
Brown & Sharpe Mfg. Co.,
Providence 1, Rhode Island

AMERICAN

NEW SHOP EQUIPMENT

Heavy-Duty Wheel Dresser Has 2-in. Cutting Face

No. 22, suitable for all dressing on medium and large wheels and particularly well suited for wide faced wheels, has 2⅝-in.-dia cutters. Six-Set bearing assembly eliminates wear on the pistol grip handle. Bearing blocks are easily indexed to present new surfaces; their hardened edges protruding from the dresser head prevent the grinding wheel from hitting the handle casting and grinding away the bearing surfaces. The six holes in each bearing are drilled through, allowing cutters to be changed without removing cutter assembly from the head. Improved cutters are extra high carbon steel, heat treated all the way through, with unusually heavy milled teeth.

Machine Products Corp, 125 Hollier St, Dayton 3, Ohio

MORE DATA? Circle 95, inside back cover

150-lb Vibration Fatigue Testers Offered in Two Improved Models

Machine, in which a vertical table movement is controlled entirely by a piston operated mechanism, is available in two improved versions. Table load capacity is 150 lb at 10 g's of acceleration. For g values higher than 10 the load must be reduced. Maximum capacity is approximately 23 g. Vibration is produced in simple harmonic motion.

Acceleration and deceleration are regulated by the Range Selector, an automatic frequency control device. On Model 150 VP-D, starting at 10 cps, frequency may be increased uniformly to 60 cps (600 to 3600 vibrations per minute). On Model 150-VP-T, available range is from 5 to 100 cps (300 to 6000 vibrations per minute). Any range of frequencies within this total range may be

◄ CIRCLE 257 READER SERVICE CARD

the special meaning of **BAIRD**

You own a machine tool that's 15 years old. You bought it new or, perhaps, used. You need spare parts. You go to the manufacturer and learn that while that same machine model is still being produced, there is no assurance that the parts you used will fit.

76H CHUCKER

This is one of the enigmas in the machine tool business today and the problem has its roots in quality control.

Here at Baird, unless there has been a complete model redesign, individual components on 1960 machines can be used on "sister" machines manufactured 25 and 30 years ago. Interchangeability is simply no problem.

NO. 1 BENCH POWER PRESS

There's another example of the special meaning of Baird to those of us charged with the responsibility of quality control. As manufacturers of high production equipment... Chuckers, Transfer Presses, Four-Slide equipment... Bench Presses and Vertical Continuous Lathes, our machines are never "finished" on the customer's floor. Before shipment, tooled machines are given good, solid production runs and parts are thoroughly checked to insure perfect operation and output. This is standard operating procedure, whether customer representatives visit us for a demonstration or not.

Do business with Baird . . . it pays.

Arthur DuBois

Arthur J. DuBois

BAIRD

THE BAIRD MACHINE COMPANY
1100 Stratford Avenue, Stratford, Conn.

CIRCLE 258 READER SERVICE CARD

Allied Chemical Corporation* Cuts Eye Accidents 85% Saves Eyes, Lowers Costs with AO Protection Program

(*Plastics and Coal Chemicals Division, Frankford Plant, Philadelphia, Penna.)

When a company or plant can cut reportable eye injuries by 85% in 10 years (1948-1958) it wins in many ways. Because eye injuries average $432 in cost for compensation alone (Source: National Safety Council), a company lowers operating costs significantly. Annual savings well up in five figures are common. Add to these the savings in first aid, hospital and medical care and in the "hidden costs"** which are considerable.

What's the cost of protection? $2.65 is the average price of safety glasses. Put them on 1,000 production workers, for example for $2,650. Prevent just 10 eye accidents (savings in compensation *alone*, $4,320). *Net* savings, $1,670. An AO Eye Protection Program featuring the right safety standard frames and lenses for man and job is an investment with built-in savings. Write for new booklet, "Eyes Are Expensive Targets."

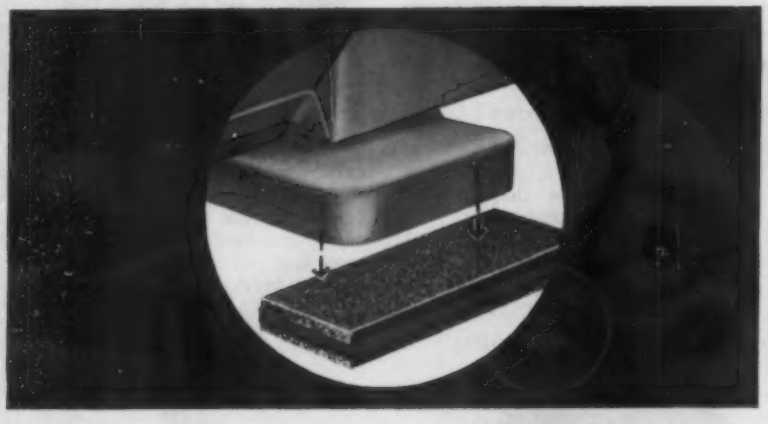
**Idle equipment charges, lowered production quality, increased spoilage, etc.

Always insist on AO Trademarked Safety Products

American Optical
COMPANY
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE, MASSACHUSETTS

Safety Service Centers in Principal Cities

Be Safe For Sure — With AO SURE-GUARD Products



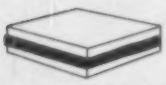
How to Install A Machine For Practically Nothing!

Plant, after plant after plant tell us that Unisorb pads more than pay for themselves by saving time, materials and labor in machine installation.

Now, whether a single unit or a whole plant, installation is a matter of minutes instead of hours. Unisorb pads are cut to size, buttered with Unisorb Cement and machine immediately set in place. No bolts or lag screws, no floor drilling, no tricky spotting. Actual savings go to 80%!

Unisorb is also a lifesaver on plant moves. A Unisorb Mounting Program, prepared in advance, speeds the entire move — production lines can be returned to operation overnight or over a week-end.

Here are the three methods that give you this money-saving machine mounting . . .



Unisorb Mounting Pads

Specially engineered in a selection of densities and thickness to provide optimum vibration control for all types of machines. Absorbs 85% of transmitted vibration, cuts noise, improves machine performance, reduces maintenance.

Unisorb Level-Rite/ Heavy Duty

The Level-Rite line has been developed for fast, precise leveling and effective vibration control. Machine legs rest on exclusive, free floating screw-post and leveling plate. No bolts, lag screws or cement required, machine is always mobile.

Unisorb Level-Rite "200"

The "Junior" model is a practical, low-cost mount for controlling vibration and maintaining level of small and medium sized machines. Ideal for light machine tools, office, air conditioning and laboratory equipment, layout benches, and shop tools. Loadings up to 200 lbs. per unit.

Remember — to simplify installation, improve performance, and control vibration . . .

UNISORB MOUNTS MAKE THE DIFFERENCE

A complete selection of densities and thicknesses for the smallest laboratory device to giant presses.

Ask for a Money-Back Trial . . . NOW!

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Division of The FELTERS Company New York, N. Y. • Chicago, Ill. • Detroit, Mich. • Upper Darby, Penna. • St. Louis, Mo. • Taylor Felt & Supply Co., San Francisco, Calif. • Acorn Mfg. Co., Los Angeles, Calif.

Please send me a Unisorb Sample and Free Book.

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Company.....

Address.....

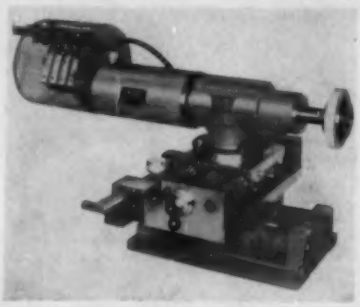
City..... Zone.... State.....

PED-48

used, such as 15 up to 45 cps and back. Range Selector can be cut out and frequencies held at any desired point within the available range. Frequencies can also be changed manually.

All American Tool & Mfg Co, 8013-C Lawndale Ave, Skokie, Ill

MORE DATA? Circle 96, inside back cover



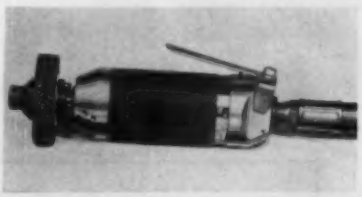
Precision Spindle Offered For Electrolytic Grinding

Anocut spindle for electrolytic grinding operates at 1000 amps and uses a 2-hp, 3600-rpm motor. The spindle is mounted on a heavy-duty universal slide equipped with large dial indicators for measuring feed of the work in ten-thousandths of an inch.

Line of spindles is motorized or belt driven to run with wheels up to 28 in. dia. They operate from 50 to 3000 amps at speeds up to 10,000 rpm. Total eccentricity of the spindle shafts is less than 0.000,050 in.

Pope Machinery Corp, Haverhill, Mass

MORE DATA? Circle 97, inside back cover

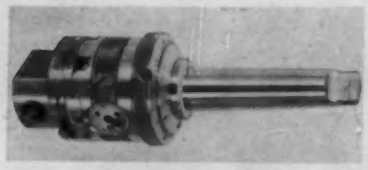


Small-Wheel Pneumatic Grinders Have Speeds to 25,000 rpm

Series 921 has choice of ten operating speeds (16,000 to 25,000 rpm) for driving small grinding wheels, rotary files, carbide burrs, and sanding and cutting discs. They are available in spindle and collet chuck models with lever, pushbutton, or ring-throttle control. Spindle and collet adapters permit them to take a wide choice of grinding wheels and mounted accessories.

Thomas C Wilson Inc, 21-11 44th Ave, Long Island City 1, NY

MORE DATA? Circle 98, inside back cover

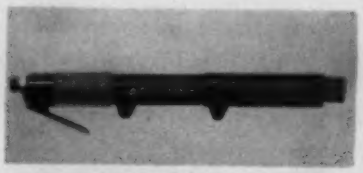


Combined Boring-Facing Tool Head Has Improved Design Features

New means of attaching the shank to the body of 1960 models of Chandler Duplex combined boring and facing tool heads is reported to preclude all chance of looseness or breakage between body and shank. Over-all height of the body has been shortended one full inch; decrease in height adds to rigidity of the tool, minimizing any tendency toward weakness or chatter. New dual means for providing takeup for wear has been incorporated permitting the operator to keep the tool in perfect adjustment. End play in the feedscrew is eliminated through adjustments in the graduated dial at rear end of body. All adjustments can be made from the outside without undue loss of time.

Chandler Tool Co, Muncie, Ind

MORE DATA? Circle 99, inside back cover



Small, Compact Air Gun Cleans, De-Rusts, De-Scales

Vonarx Model 1B, made in Switzerland, is designed for cleaning of weld slag and for general cleaning of steel and concrete before painting. Weight is 3.3 lb, over-all length 13.5 in., diameter 1/25 in. It operates on compressed air and is equipped with stainless steel needles controlled by a trigger on the handle releasing a flow of air which sets the needles into rapid back and forth action. Air continues on through the pistol blowing the working surface clean of particles.

Needles operate at 50 strokes per second; total stroke length is 1 in. Air consumption is 12.5 cfm, air pressure is 80-100 psi. Tool can be equipped with either 2 or 3-mm size needles, life of which is reported to be in excess of 200 hr.

Swissair Tool Corp, 775 Sheridan Dr, Buffalo 21, NY

MORE DATA? Circle 100, inside back cover

feature by feature... the latest

LINLEY

JIG BORER

IS A TOP PERFORMER IN TODAY'S TOOLROOMS WHERE ACCURACY IS ESSENTIAL

1. Accurate to a high degree, the Linley is fast to set up and position and has the versatility required for precision tool work.
2. Ribbon type locks on both table and saddle for positive no-shift locking add to its dependability and lasting accuracy.
3. A tiller-type wheel facilitates final adjustment of the sliding head, raising and lowering it rapidly to exact degree desired.
4. A pin type lock for the spindle, speeds insertion and removal of tools and requires only one spanner wrench instead of two.
5. Feed screws on both table and saddle are an extra large size, ⅜" diameter, and heat treated for long wear with extreme accuracy.

Designed And Built For Precision Operation

The Linley Jig Borer is a precision machine designed specifically for small tool and die work and reasonably priced. It is available with many time saving accessories that add to its usefulness and speed.

We invite your inquiries; write for specifications, prices.

LINLEY BROTHERS CO.

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MODERN FACILITIES-

Plus

CONSTANT QUALITY AND METALLURGICAL CONTROL in every step of processing

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Four modern, well-equipped mills at Ambridge, Pa.; Chicago, Ill.; Newark, N.J.; and Putnam, Conn., insure prompt deliveries and service for all of your cold drawn steel requirements.

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SPECIALISTS IN COLD FINISHED STEELS EXCLUSIVELY

WYCKOFF STEEL COMPANY

GENERAL OFFICES:
Gateway Center, Pittsburgh 30, Pa.

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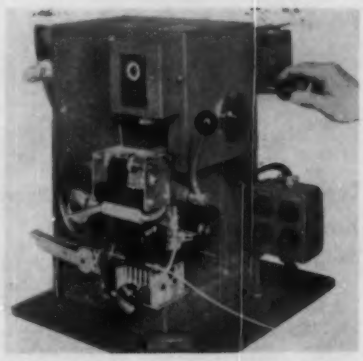
Works: Ambridge, Pa., Chicago, Ill., Newark, N.J., Putnam, Conn.

WYCKOFF STEEL PRODUCTS • Carbon, Alloy and Leaded Steels • Turned and Polished Shafting • Turned and Ground Shafting • Large Squares • Wide Flats up to 12¾" x 2¼" and 14" x 1¼" • All types of Furnace Treated Steels including Carbon Corrected Steels



Automatic Wire and Tube Marker Operates at 173 spm

Model MWS-2 automatic wire and tube marking machine is equipped with a 110-v ac motor and operates at 173 spm. Adjustable stamping depth and wire feed length is standard on all units.

Standard models have a feed adjustment of 1 to 10 in. but a range of 1 to 18 in. is also available. The length of feed may be changed while the machine is operating. Replaceable holders hold up to 1½ in. of type. Universal style wire and tube guide adjusts for wire sizes AN-26 through AN-0000 and for tubing from 1/16 to 1½ in. OD.

Automark Co, 1920 S Vandeventer Ave, St Louis 10, Mo

MORE DATA? Circle 101, inside back cover

Internal Measuring Gage Doubles As Comparator

Intertest dial gage is designed to measure narrow deep keyways, slots, and small bore diameters.

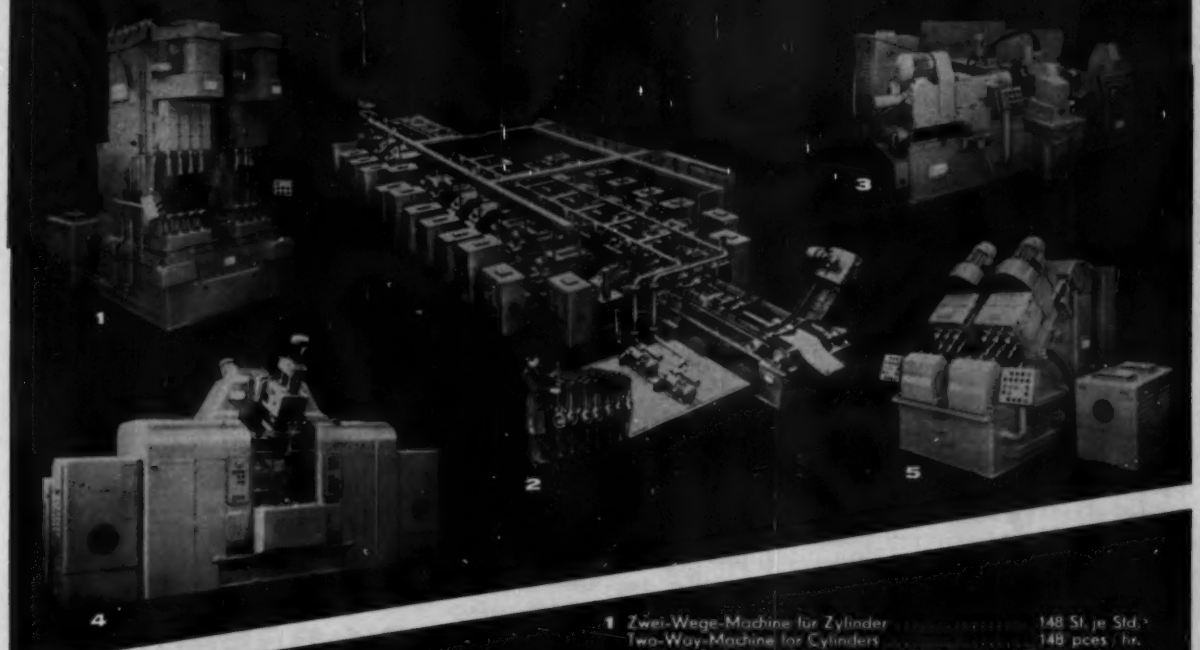
Four models cover ranges from 0.2 to 1.6 in. Graduations are 0.0005 in. on two low range models and 0.001 in. on two high range models. The graduated scale ring can be rotated to set zero at any point of the gage's range, and the unit will then perform as a comparator.

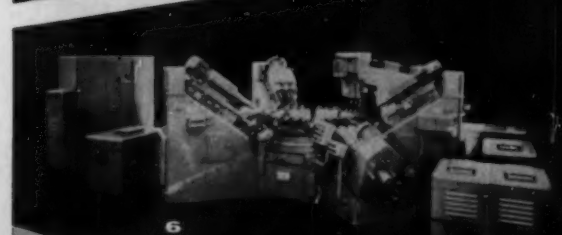
Testing Machines, Inc, 72 Jericho Tpqe, Mineola, NY

MORE DATA? Circle 102, inside back cover

Burr

- PRECISION FINISHING MACHINES
- ALÉSEUSES DE FINITION
- ALESATRICI DI FINITURA
- SPECIAL MACHINE TOOLS
- MACHINES D'OPÉRATIONS SPÉCIALES
- MACCHINE UTENSILI SPECIALI
- TRANSFER MACHINES
- MACHINES TRANSFERT
- MACCHINE TRASFERTE





1 Zwei-Wege-Maschine für Zylinder ... 148 St. je Std.
Two-Way-Machine for Cylinders ... 148 pces. / hr.
Machine Spéciale à 2 Voies pour cylindres ... 148 pièces/heure
Macchina a Due Vie per Cilindri ... 148 pezzi/ora

2 Transferstraße für Hinterachsbrücken ... 80 St. je Std.
Transfer Line for Rear Axle Bridges ... 80 pces. / hr.
Machine Transfert pour corps de pont arrière ... 80 pièces/heure
Linea a trasferta per Ponti Posteriori ... 80 pezzi/ora

3 Drei-Wege-Maschine für Spindellenkgehäuse ... 10 St. je Std.
Three-Way-Machine for Steering Boxes ... 10 pces. / hr.
Machine Spéciale à 3 Voies pour boîtiers de direction ... 10 pièces/heure
Macchina a Tre Vie per Scatole Sterzo ... 10 pezzi/ora

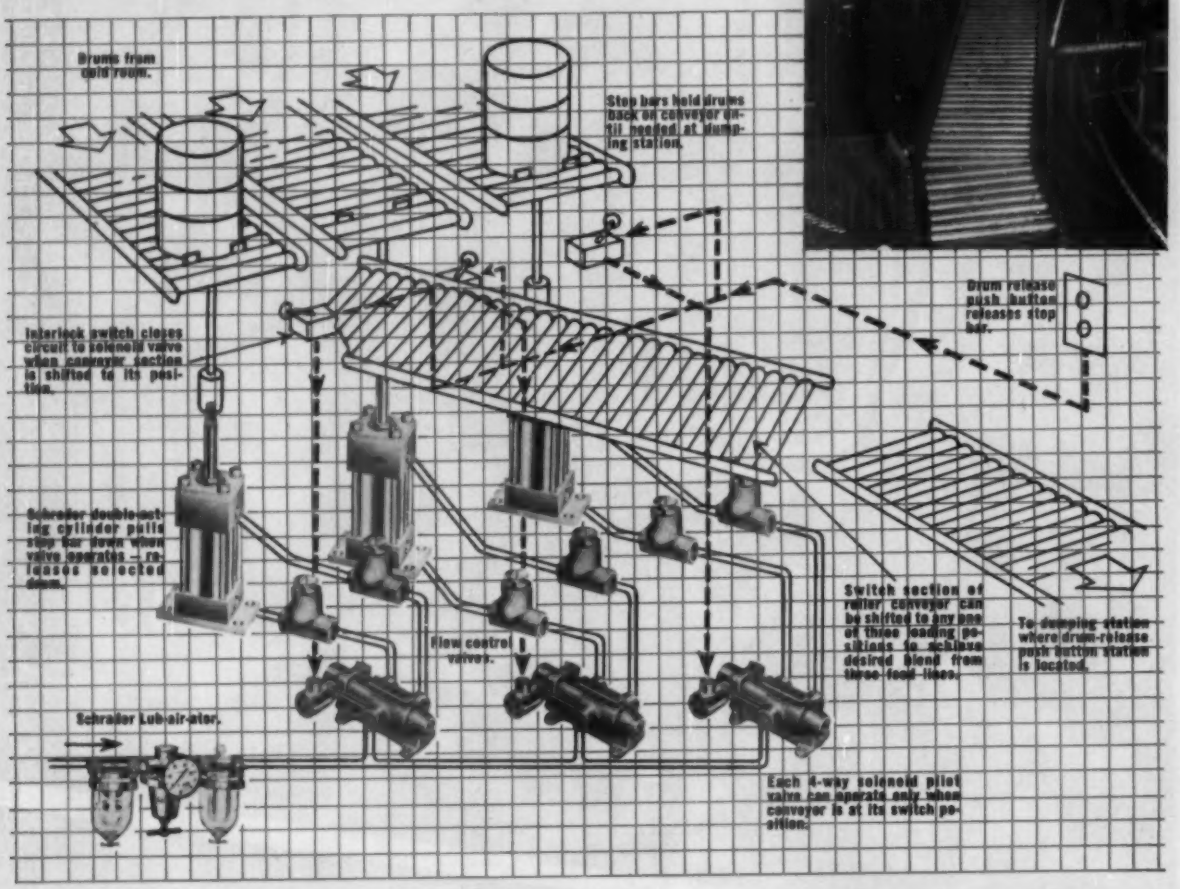
4 Trommelbohrwerk für Kreuzstücke ... 114 St. je Std.
Drum Type Machine for Spiders ... 114 pces. / hr.
Machine Tambour pour croisillons ... 114 pièces/heure
Macchina a Tamburo per Crociere ... 114 pezzi/ora

5 Zwei-Wege-Maschine für Pleuel ... 210 St. je Std.
Two-Way-Machine for Connecting Rods ... 210 pces. / hr.
Machine Spéciale à 2 Voies pour bielles ... 210 pièces/heure
Macchina a Due Vie per Bielle ... 210 pezzi/ora

6 Rundtischmaschine für Bremszylinder ... 350 St. je Std.
Rotary Indexing Table Machine for Brake Cylinders ... 350 pces. / hr.
Machine Spéciale à Plateau Tournant pour cylindres de frein ... 350 pièces/heure
Macchina a Tavola Circolare per Cilindri Freno ... 350 pezzi/ora

LUDWIGSBURGER MASCHINENBAU GMBH
LUDWIGSBURG/GERMANY

Processors automate even heavy work with air. In a complex frozen juice concentrate blending operation, Plymouth Citrus Products Cooperative, Plymouth, Fla., hooks up Schrader Air Products simply and economically to a gravity conveyor. Full 55-gal. barrels on feed sections roll down to stop bars and are selected in correct order and ratio for dumping. "The Schrader system performs well," says C. Byron Smith, plant manager. "We're handling 200 to 300 barrels a day on this selective conveyer, and could handle more."


Drums from cold room.
Stop bars hold drums back on conveyor until needed at dumping station.
Drum release push button releases stop bar.
Interlock switch closes circuit to solenoid valve when conveyor section is shifted to its position.
Schrader double-acting cylinder pulls stop bar down when valve operates — releases selected drum.
Flow control valves.
Switch section of roller conveyor can be shifted to any one of three loading positions to achieve desired blend from three feed lines.
To dumping station where drum-release push button station is located.
Schrader Lub-air-ator.
Each 4-way solenoid pilot valve can operate only when conveyor is at its switch position.

PROCESSOR AUTOMATES BACK-BREAKING CHORE WITH SCHRADER AIR PRODUCTS... GAINS SPEED, EFFICIENCY, BIG ECONOMIES

Solve difficult problems of handling, conveying and sorting, just like this company . . . with air! Versatile Schrader Air Products take punishing environments in stride, even corrosive atmospheres . . . Work together like magic on American production systems of many different kinds in hundreds of industries.

You already have air. Add Schrader Air Products to push, pull, hold, position, move work repetitively . . . cure headaches of weight, assembly, production maintenance . . . perform tirelessly and with precision. Speedy yet safe Schrader takes the drudge out of work, adopts to special needs, saves time, money and effort.

Select from the full Schrader lines to plan your automation of machines. Your Schrader distributor can help you pinpoint what you need. For more data write:

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QUALITY AIR CONTROL PRODUCTS

FIELD REPORT...

Ingersoll-Rand Talks Merger With Black & Decker

Ingersoll-Rand Co and Black & Decker Manufacturing Co, Towson, Md, producer of portable power tools and accessories, are discussing the possibility of merging. Ingersoll has been eying the Maryland firm since 1955 and last year purchased about 10% of B&D common stock.

$47 Million Contract Goes to Seattle Shipyard

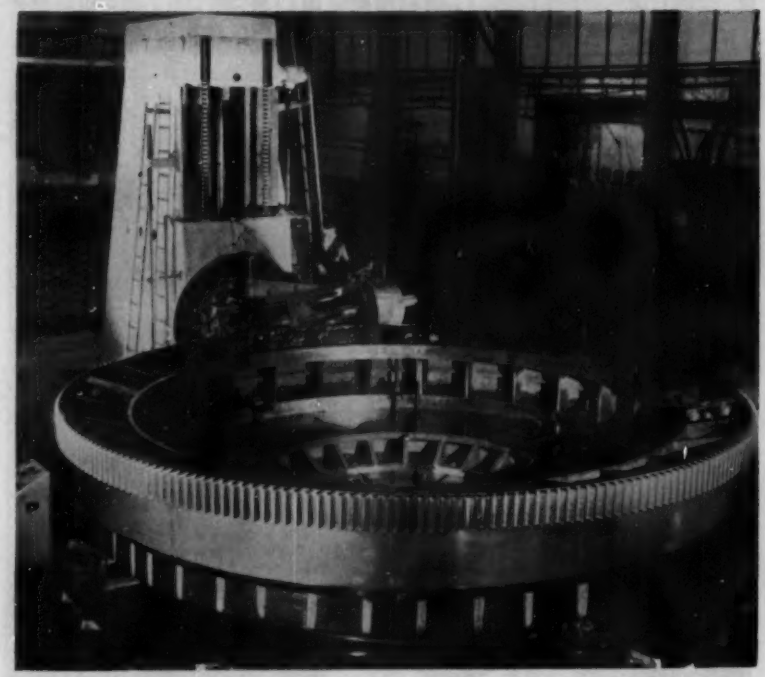
Navy has awarded a contract for construction of three guided missile destroyers to the Puget Sound Bridge & Drydock Co, Seattle subsidiary of Lockheed Aircraft. Bid was the lowest of eight received. Ships will each have two twin launchers for Tartar antiaircraft guided missiles; they'll also be equipped with antisubmarine rockets and torpedoes, 5-in. guns, and long-range sonar.

Ford Converts Fourth Plant For Falcon Production

The San Jose, Calif, division of Ford Motor Co has converted its entire assembly plant car facilities to Falcon production; changeover will increase Falcon production capacity by about 2000 units monthly. San Jose is the fourth Ford assembly plant to switch to exclusive production of the compact car and truck.

US Firm to Distribute Gages Made by New French Process

Bordie Products Inc has been formed in Ferndale, Mich, to handle US distribution of gages and other industrial tools made of boron carbide produced by a patented French process. The process is said to yield a boron carbide flour of uniformly fine grain which is particularly well suited to use in plug and ring gages, grinding wheel molds, dressing sticks, and pressure blasting nozzles, all of which the French firm produces. Standard sizes and shapes of nozzles and gages are carried in stock in Ferndale where fabrication will eventually be carried on. Special orders from France are available on four-week lead time.



This hobbing machine at the David Brown Jackson Division factory in Salford, England had to be quickly converted from 16½ to 32-ft-dia capacity to handle an order for unusually large gearing that called for supply of eight sets of combined gear and path rings with pinions. Gears to be hobbed were up to 32 ft in diameter, 10 ft face width, 70 tons in weight, and 4 in. circular pitch. Metal removed from the path and ring gears alone totaled 15½ tons

Westinghouse Ends Jet Work

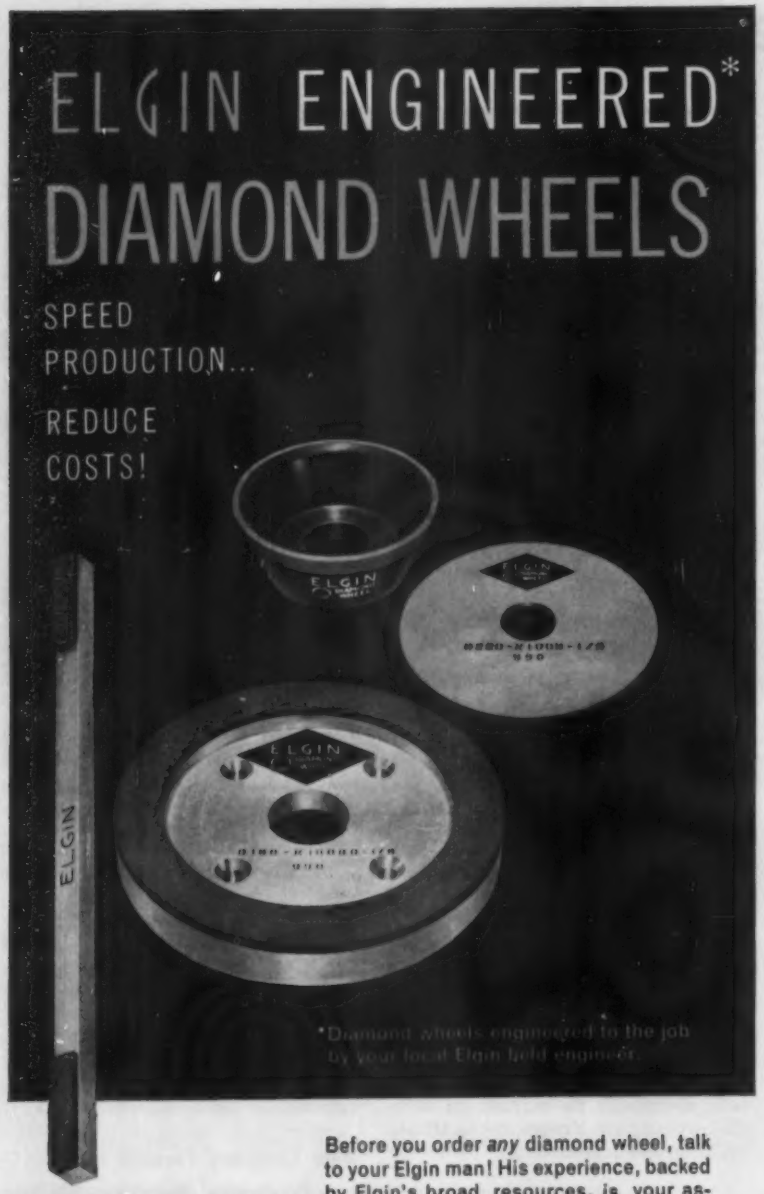
Westinghouse Electric Corp is getting out of the jet engine business. Delivery of J34 engines under contract to the Navy will be completed about mid-year, but company's Kansas City plant will continue to operate until the end of the year to make spare parts. Westinghouse doesn't say how many employees will be affected, but a program has been set up to provide more than $2 million in benefits for those laid off.

New Company Formed for Low-Frequency Induction Melting

Inductotherm Linemelt Corp, Delanco, NJ, will manufacture a complete line of core-type induction melting equipment based on designs developed by J Lloyd Hoff, president of

McGIRK'S WORKS by GEO. CRENSHAW

8:00 A.M.
DITTO ROOM
4:25 P.M.
DITTO ROOM
5:00 P.M.
WHAT'S FOR DINNER?
WHAT'S FOR DINNER?
WHAT'S FOR DINNER?
MOE'S CORNER
I can't stand people who repeat themselves over an' over an' over an' over an' over an' over again!



Before you order *any* diamond wheel, talk to your Elgin man! His experience, backed by Elgin's broad resources, is your assurance of maximum production efficiency, quality of finish and long wheel life!

First select the style you need from Elgin's *complete* line of diamond wheels, then the Elgin man will help you specify the very best bond, grit, concentration, hardness and bond modification—and tell you whether to use *natural* or *man-made* diamonds.

Call your local Elgin Abrasives Distributor or Field Engineering Office today, or write direct to:

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ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS

Field Report . . .

the new organization, and formerly chief engineer of Ajax Engineering Corp. In addition, the new company has an agreement to handle Swiss-made Brown Boveri coreless low-frequency melting furnaces in the US which includes installation and service as well as design engineering and component specification to meet the requirements of American manufacturers.

Howe Sound Acquires Peterson Machine Tool

Howe Sound Co has acquired the outstanding stock of Peterson Machine Tool Co, Merriam, Kans. Company will become part of Sperry Products Co, a Howe division located in Danbury, Conn.

Peterson product line includes Sonoflux equipment for the magnetic particle inspection field. It also manufactures vertical surface grinders and has recently introduced a new and improved wet vertical surface grinder designed to replace dry grinding.

Bridgeport Brass Closing in Mich

Bridgeport Brass Co has notified the 615 employees of its Adrian, Mich, aluminum extrusion and forging factory that the plant will close its doors April 30. The firm's $25 million facility has been steadily losing the business it needs to survive, according to Vice President Richard W Summey. In addition, he reports, high wage rates and fringe benefits have made it difficult for the company to compete with smaller plants for non-defense work. Bridgeport leased the factory from the Air Force in January 1954.

The plant is the second to leave the city within the last four months. Last December 200 employees of Hoover Ball Bearing Co lost their jobs when the facility shut down.

New Division Set Up By Electric Autolite

Special Products and Research and Development Division (SPARD) has been formed by Electric Autolite of Toledo to facilitate diversification programs of the company. Firm recently announced development of a number of subminiature hydraulic and electro-hydraulic devices with wide application in the industries it now serves as well as in the missiles

and rockets field. SPARD will begin pilot production of some of the devices and will follow with other production in electrical, electronic, and mechanical controls as well as increase its R&D work in semi-conductors and fuel cells.

Scott Paper Co-Owns a Shipyard

Scott Paper Co and Pacific Towing Co of Everett, Wash, and Western Gear Corp of Belmont, Calif, have teamed up in the purchase of the Everett Shipyards located on 70 acres of land 20 miles north of Seattle. Facilities were sold by the General Services Administration for $2.1 million, most of which was put up by Western Gear.

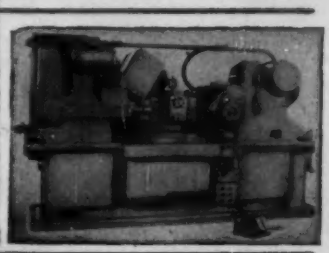
New Conn Firm Producing Electronic Controls

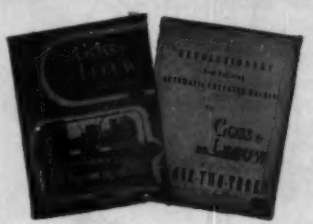
Electronic Controls Inc has been formed recently in Stamford, Conn, for the design, manufacture, and marketing of automation equipment and control systems for military and industrial applications. Plans call for extensive operations in all phases of automation, based upon electronics and control technology. Its manufacturing division is in full production and has begun delivering electronic motor drives for automatic speed control of machine tools and other electrical machinery. Also in manu-

(continued on p 176)

"Why don't you just learn to live with my faults—I did."

Single set-up covering
ALL finishing operations...
MEANS GREATER ACCURACY *with* **GOSS DeLEEUW**





AUTOMATIC CHUCKING MACHINES

One of the many important advantages being realized with this new chucker is the performing of ALL finishing operations on a single chucking of the work. In addition to the time saved, this feature, exclusive with Goss & DeLeeuw "1-2-3" machines, means only one handling of the work with an attendant greater accuracy. This machine is in a class by itself in precision finishing.

In Goss & DeLeeuw "1-2-3" Automatic Chucking Machines, one, two, or three ends of the work are machined simultaneously or in sequence. There is no need for resetting, retooling or secondary operations. More work from one machine and greater accuracy are matters of record.

Ask for illustrated literature describing the operation of this chucker in detail. Send samples of your work for time and cost estimates.

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Perfected by
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Resistance Welding
Spot • Projection • Seam
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EXCLUSIVE
Synchro-matic and Synchro-shear*
...for jobs no other resistance welders can do

THOMSON QUALITY is so important that we build our own transformers to assure maximum performance and reliability. For all **AUTOMATED** and **HIGH-PRODUCTION** requirements — either special or standard design — **THOMSON QUALITY** is within your budget. A **THOMSON** quote will prove it.

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THOMSON ELECTRIC WELDER COMPANY
161 PLEASANT STREET, LYNN, MASSACHUSETTS
LYnn 2-7710

Field Report . . .

facture are electronic controllers and power sources for spectrophotometers and spectrofluorimeters.

NRC Gets Tantalum Contract

National Research Corp, Cambridge, Mass, has a Navy contract for research and development on tantalum and tantalum-tungsten for nozzles and other parts of solid-fuel rocket propulsion systems. Tantalum-tungsten alloys already tested by NRC have over three times the tensile strength of tantalum alone at 4000 F and are easily fabricated. NRC is a manufacturer of tantalum metal powder used as the starting material for fabrication.

$2.7 Million in Contracts Goes to American Electronics

A $2 million order for ground support generator spare parts on the AF F-106A has been awarded by Convair San Diego to American Electronics Inc, Los Angeles. Second contract, for mobile air conditioners for the B-58 manned bomber program, comes from Convair Fort Worth. Work, to be done by AE's Ground Support Division (formerly the Electric Machinery and Equipment Div), will begin immediately with completion scheduled in 120 days. These contracts bring AE's backlog to approximately $12.9 million compared with backlog of $7 million a year ago.

"Since those management consultants made their improvements, we're as inefficient as ever, but at least now we know why."

Standard Costs For Manufacturing

Just Published. A practical guide for installing and operating a money-saving standard cost system. Shows how to set standards and control operational expenses for direct and indirect labor, maintenance labor and materials, operating supplies, general overhead, etc. Explains how to use standard costs to simplify accounting procedures, budget forecasting, and incentive planning. **By S. B. Henrici, Ind. Mgr., H. J. Heinz Co. 3rd Ed., 392 pp., $8.50**

Tool Engineers Handbook

Authoritative data on the design, fabrication, maintenance and economical use of industrial tools and machinery. Covers everything from product design and cost estimating —through economic selection of machines, processes, and tools — to analysis and improvement of operations. **By American Society of Tool and Manufacturing Engineers, F. W. Wilson, Editor - in - Chief. 2nd Ed., 2150 pp., over 2000 illus., $19.50**

Oil Hydraulic Power and its Industrial Applications

Covers modern practice in oil hydraulic components, oil circuits, and applications, and discusses fluid mechanics as applied to oil under pressure—generation of oil hydraulic power — representative oil hydraulic-powered and controlled machines — and elementary and complex circuits. **By Walter Ernst, Hydraulic Consulting Engineer. 366 pp., 275 illus., $12.50**

Machine Shop Estimating

Here's on-the-job help to make quick, reliable estimates of the time it takes to do the different machining operations in any machine shop—large or small. Describes every operation from drilling and boring to threading and grinding—every step from setting up a job to tearing it down—giving the specific time value for each element of the work. Includes sample estimates for each operation described, tables of variants and constants, etc. **By W. A. Nordhoff, Douglas Aircraft Corp. 2nd Ed. 544 pp., 344 illus., $9.00**

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IT'S NEW

Bulletin 700 Type BR Relay with all six of the convertible poles arranged for normally open contact operation.

Allen-Bradley Convertible Contact CONTROL RELAY

BULLETIN 700

TYPE BR

Changeover made in seconds!

The contacts of the new Type BR relay can be arranged for either normally open or normally closed operation—and any changeover in the field can be made in seconds. A screwdriver is all that's needed.

This new A-B Bulletin 700 Type BR relay is ideal for use on automatic machines where control functions are frequently altered to meet production changes.

Quick convertibility of the contacts enables easy "on-the-spot" changes—from "normally open" to "normally closed"—or vice versa.

These new Bulletin 700 Type BR relays have been exhaustively tested to make sure that they will provide the many millions of trouble free operations for which all A-B controls are famous. In fact, the Bulletin 700 Type BR relays will establish new standards for long relay life and "reliability" of contact operation. Of course, they have double break, silver contacts that never need attention; also, the molded coil is impervious to the most severe atmospheric conditions.

Please write for full details, today!

Two extra convertible poles can be easily added—in the field

An auxiliary convertible contact pole—having full switching capacity—can be easily added to the left and right sides of the Type BR relays. These auxiliary poles are front-mounted and can be added without disturbing the wiring of the relay—and without removing the relay. All relays are designed to also accept stab connectors, and—all terminals are accessible from the front.

Allen-Bradley Co, 1310 S. Second St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY QUALITY MOTOR CONTROL

Precision mist control for any machine tool. Bijur Spraymist provides the most efficient use of air and coolant—atomized right at the tip of the jet. The mist evaporates upon contact and cools as it evaporates. This keeps the work, the machine and the operator clean and dry—and insures full-time visibility of work. With extension jets and flexible Dual Hose lines, mist can be directed exactly where needed—between work and tool . . . on any job . . . on any machine.

Spraymist, the fully pressurized system is available in 18 oz., 1 gal. and 5 gal. units. The 5 gal. unit can handle up to 20 jets.

No wonder machine tool builders find Spraymist is an excellent sales point, and machine tool users insist on *engineered* Spraymist to keep production up, and costs down. Write today for details.

BIJUR LUBRICATING CORPORATION
Rochelle Park, New Jersey
Pioneers in Automatic Lubrication

Field Report . . .

Thompson Ramo Wooldridge . . .

. . . is acquiring controlling interest in Good-All Electric Mfg Co of Ogallala, Nebr, which manufactures a variety of electric components. A leader in the introduction of Mylar and film-type capacitors, Good-All produces capacitors for industrial equipment and military use in addition to lowcost capacitors used in home television and radio receivers. Company, with 1127 employees, holds a minority interest in Radio Kemetal Industries Inc, part of which was acquired last year by TRW when it bought control of Radio Industries Inc of Des Plaines, Ill.

Chicago Firm Moves to SC

U-Mix Buffet Corp, Chicago vending machine manufacturer, is moving to Ridgeland, SC. It'll begin full operations within the next two months and will gradually shift all of its manufacturing to Ridgeland.

Wahl Clipper Corp . . .

. . . Sterling, Ill, has purchased the L C Wrench Corp of Chicago. All facilities will be moved to Sterling and located in a portion of the new Wahl hom eplant. To be known as the L C Wrench Division, it'll continue to manufacture internal wrenches for socket wrenches and impact tools.

Eaton Research Center

A $1.2 million research center, its second in Detroit, will be built by Eaton Manufacturing Co, Cleveland, maker of parts for planes and automobiles. Building will have 28,750 sq ft of working area and will be completed late this year.

$23 Million in Contracts . . .

. . . have been awarded by Navy to three firms for nuclear submarine propulsion equipment. General Electric Co and Westinghouse Electric Corp each have $9.3 million orders for four subs apiece, and De Laval Steam Turbine Co has a $4.7 million contract for equipment for two more.

Eitel-McCullough Inc . . .

. . . San Carlos, Calif, manufacturer of Eimac electron-power tubes, and English Electric Valve Co, Chelmsford, England, have made a licensing agreement for exchange of manufacturing rights and technical information. Agreement will potentially expand the product lines of the two

electron-tube companies in the field of negative-grid tubes, klystrons, and traveling wave tubes. It allows each company to manufacture the other's products and market them internationally.

Tri-Point Plastics to Build Special Plant for Teflon

Plastics facility designed to process Teflon fluorocarbon resins exclusively will be constructed by Tri-Point Plastics Inc, specialist in the production of ultra high precision machined components of Teflon for the electronics, missile, instrument, and other industries. Plant, which will be adjacent to the company's present facility in Albertson, NY, will house special process control and fabricating equipment, and is being planned with the technical assistance of the DuPont Co, developer of the fluorocarbon polymers. In addition to tripling the company's existing fluorocarbon extrusion capacity, it'll provide for high precision molding-forming operations on standard as well as newer types of Teflon.

Northrop Corp's Nortronics Div . . .

. . . Los Angeles, has contracts totaling $22.6 million for continued production and engineering work on the Army Hawk missile.

"I don't like to keep complaining to you, Buxton, but there's a company rule that says I can't hit you."

Hotpoint relies on . . .

FEDERAL-WARCO

Federal Multi-gun, combination spot and projection welders are a vital link in the exacting production schedules of Hotpoint ranges. The Federal unit shown below welds and forms range frames—adjusts to accommodate five cabinet sizes—maintains high Hotpoint volume without sacrificing quality standards.

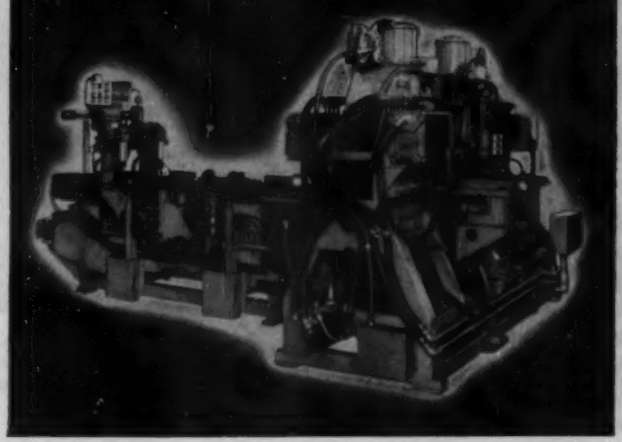
Leading metal fabricators throughout the country have learned they can rely on Federal resistance welders and Warco mechanical presses for dependable high speed performance. Precision engineered to your exact requirement by

THE FEDERAL MACHINE AND WELDER COMPANY
Warren, Ohio

Federal WELDERS

Warco PRESSES

Federal Multi-gun, Combination Spot and Projection Welder #58W3096A-B



ACCURACY

MASSIVE, ROUGH CASTINGS . . . are machined quickly and efficiently on the Barth Corporation's big, powerful BG-21 KELLER Automatic Tracer-Controlled Miller.

ACCURATE MACHINING . . . on the KELLER Machine means that this big automotive die will require only a minimum of barbering.

INTRICATE 3-DIMENSIONAL SHAPES . . . like the job shown here, are duplicated quickly and accurately, as the cutter follows the sensitive tracer.

ASSURED...

...AND INTRICATELY CONTOURED DIES PRODUCED QUICKLY, ECONOMICALLY WITH

KELLER Automatic Tracer-Controlled Millers

TRADEMARK®

One of the country's largest tool and die manufacturers, the Barth Corporation, of Cleveland, Ohio, has depended for many years on KELLER Automatic Tracer-Controlled Millers to produce large, intricately contoured dies for the automotive, aircraft-missile, appliance and other industries.

Shown opposite with one of his company's KELLER Machines, Mr. John Barth – Vice President and General Manager of Barth Corporation and newly elected President of the National Tool and Die Manufacturers' Association – states, "KELLERS do intricate die jobs not otherwise possible and do them quickly and accurately. In our plant, these machines are highly regarded and are considered the only machines for the job."

At Barth Corporation, KELLER Automatic Tracer-Controlled Milling Machines are used to reproduce large plaster full-models in tool steel, with speed, efficiency and economy – producing the dies that will manufacture components for the nation's newest automobiles and appliances. Operation is easy; there is no work spoilage and no maintenance problem.

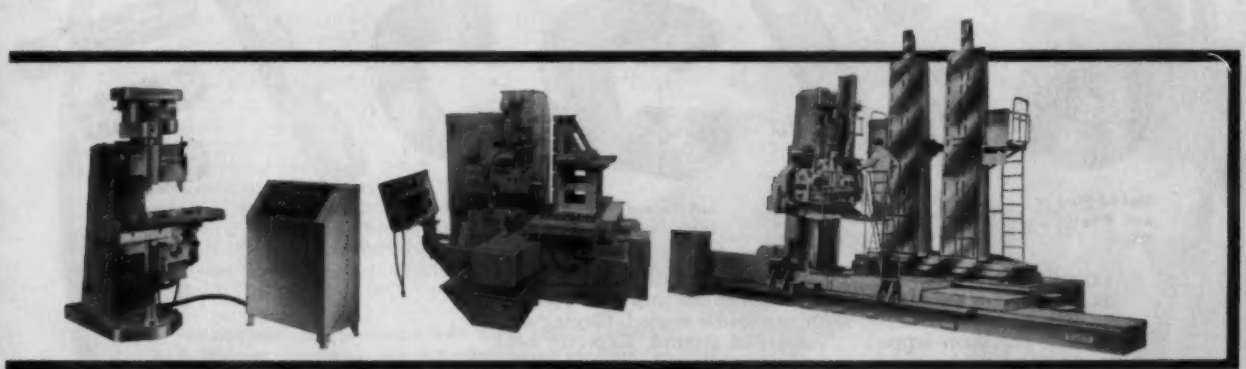
Dies, molds, prototype parts, limited-run production – and anywhere that intricate, 3-dimensional contours must be machined with speed and accuracy – a KELLER Automatic Tracer Controlled Milling Machine can help you turn out better work at lower cost. Write now for complete information, stating the work-size range you require. Pratt & Whitney Company, Inc., 11 Charter Oak Boulevard, West Hartford, Connecticut.

100th Anniversary 1860 1960

PRATT & WHITNEY®

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS



A COMPLETE LINE OF KELLER MACHINES . . . for every work size requirement is produced by Pratt & Whitney. From the compact Type BL (center) to the giant Type BG-22 (right), they provide travel capacities from 36" x 20" to 20 ft x 7 ft. Also included is the precision VELVETRACE® (left) with non-contacting tracer control capable of duplicating the finest detail to "tenths" accuracy.

Field Report . . .

Lockheed's Georgia Division . . .

. . . at Marietta will receive 103 B-47 stratojet medium bombers for modification, inspection, and repair work during the next government fiscal year beginning July 1. Size of the work package to be done on each of the SAC bombers has been reduced to about half of the modification work presently being done on B-47's at Marietta. Current year's program includes approximately 100.

Coated Abrasives Firm Moves to Detroit Area

Coated Abrasives Inc has transferred manufacturing and headquarters operations from Milwaukee to the Detroit metropolitan area. Company manufactures a full nine of abrasive specialty items and engages in coated-abrasive application research.

Modern Manufacturing Co . . .

. . . Willow Grove, Pa, has bought the Super Slugger Co of Bedford, Ohio, and is transferring machinery and equipment to its own plant. The Bedford firm manufactured the Super Slugger electric hammer; production of this portable tool will continue under the name of Modern Slugger Hammer as part of Modern's line of nibblers, combination drill saws, air powered hammers, and portable punchpresses.

Company Formed to Produce Specialized Metallurgical Products

Metronics Inc has been established in Englewood, NJ, for production of tungsten and molybdenum rod, wire, and electrodes; tantalum and columbium rod and wire; and a variety of special alloys. It'll offer nationwide sales and technical services on specialized metallurgical products.

Lear Gets New Nike-Zeus Funding

Lear Inc, Santa Monica, Calif, has received $2.3 million in additional funding on the Army's Nike-Zeus anti-missile missile from Bell Telephone Laboratories, in charge of system development. With the new funding, Lear's Instrument Division at Grand Rapids, Mich, will continue working on the missile's gyroscopic control instruments. This brings to $9.3 million the total awards to the company in the Nike-Zeus program since its original contract from Bell in March 1957.

Hayes to Stay in Birmingham

Rumors that Hayes Aircraft will close down its Alabama plant aren't true. Hayes, which has been known primarily as an aircraft company, is moving into advanced weapons systems development; at present 72% of its dollar volume is in missiles. Shift accounts for recent employment cutbacks — company requires less total employment, but an increased number of technically qualified personnel.

Food Machinery & Chemical Corp

. . . San Jose, Calif, has acquired a substantial interest in Luceat, SA, of Sens, France, maker of electrification equipment, petroleum industry equipment, and other industrial products. FMC's interest in Luceat will be handled by FMC International. French concern will serve petroleum industry markets in France and the European Common Market for FMC.

ACCURACY ASSURED...

CONVENTIONAL GAGES

Thread Plug and Ring Gages

Pipe Thread Gages

Roll Thread Snap Gages

Adjustable Limit Snap Gages

Cylindrical Plug and Ring Gages

Precision End Measures

Available in complete lines for all your applications, P&W Conventional Gages are unequalled in quality, because the skill and care that goes into making them cannot be copied. Gaging surfaces are precision lapped . . . not just ground. Expertly heat treated for superior hardness and dimensionally correct, P&W Conventional Gages insure dependable, accurate inspection plus longer wear life.

100th Anniversary 1860 1960

FIRST CHOICE FOR ACCURACY

PRATT & WHITNEY

CIRCLE 275 READER SERVICE CARD

Helicopter Maker Eying Dallas

A Florida manufacturer who hopes to have a 300,000 sq-ft helicopter assembly plant built near Dallas, Texas, by 1961 has been conferring with city officials about the plan. Raymond E Umbaugh of Ocala, Fla, whose $10,000 autogyro-helicopter is now manufactured at Fairchild Engine & Aircraft Co in Hagerstown, Md, expects to deliver about 1000 of them in Texas "as soon as we can have them built."

Hewlett-Packard Co Building

Company, headquartered in Palo Alto, Calif, has started construction of a $1 million electronics plant in Loveland, Colo. Facility will start production in June with full operation scheduled for year's end. Initial employment will be 100.

Ford Truck Order

Ford Division of Ford Motor Co has a $4.6 million Defense contract for 3482 pickup trucks. Order calls for delivery by this summer. The vehicles will be produced in assembly plants at San Jose, Calif; Mahwah, NJ; Kansas City, Mo; Lorain, Ohio; Atlanta, Ga; Norfolk, Va; Dallas, Texas; St Paul, Minn; and Chicago.

Park Industries . . .

. . . maker of pocket cigarette lighters, will transfer its entire operation to Murfreesboro, Tenn, from Springfield, Ill. Facility will turn out steel tape measures and cigarette cases as well as lighters.

Canco Division . . .

. . . of American Can Co has opened its new 150,000 sq-ft Atlanta manufacturing plant. Production will include metal cans of fruits, vegetables, soft drinks, and beer. Full employment will be 250.

Progressive Welder Alters Name

Consolidation of all Progressive Welder properties has been voted by the board of directors; new corporation will be known as Progressive Welder & Machine Co with corporate offices in Detroit. Change has been effected at the opening of Progressive's twenty-fifth year in resistance welding equipment manufacturing.

260 New Freight Cars . . .

. . . worth approximately $3.7 million, have been ordered by Western Pacific Railroad. Pacific Car & Foundry, Renton, Wash, will build 200 insulated box cars; Thrall Car Manufacturing Co, Chicago, will produce 50 seventy-ton flat cars. Ten covered hopper cars will be built by American Car & Foundry Industries for use by Sacramento Northern Rwy, a subsidiary of Western Pacific.

Thiokol OK's Rocket Engine

Thiokol Chemical Corp, Trenton NJ, reports that all pre-flight tests of the rocket engine for the X15 high speed aircraft have been successfully completed. This means, company adds, that the US has a fully controllable rocket engine for manned flight.

Crane to Open Plant in Arkansas

A million-dollar plant at Jonesboro will be opened by Crane Co of Chicago for manufacture of plumbing brass and low pressure bronze valves. Facility will employ 400 and will have an annual payroll of $1.5 million.

with PRATT & WHITNEY GAGES

TRI-ROLL
THREAD COMPARATORS

Fast and easy to operate, extremely accurate, and unusually versatile, P&W Tri-Roll Thread Comparators can be used with full-length rolls to provide a complete *functional* check . . . detecting errors in lead, angle, pitch diameter, and deviation from true helical path. Using interchangeable single-rib rolls, they provide a *critical* check of pitch diameter . . . duplicating the precise 3-wire method *on a production basis!*
For a complete discussion of the Tri-Roll Method for profitable control of precision threaded parts production, ask for P&W Circular No. 606.

For complete information about these and other Pratt & Whitney Gages — and for application engineering service — call your Local P&W Branch Office . . . or write direct to Pratt and Whitney Company, Inc., 11 Charter Oak Blvd., West Hartford, Connecticut.

"JOB ENGINEERED" MACHINE TOOLS • GAGES • CUTTING TOOLS

CIRCLE 276 READER SERVICE CARD

VISIT OUR BOOTH
DETROIT '60 APRIL 21-28
ASTE TOOL SHOW

BUX 2242

NEW!

BUX RADIAL POSITIONER

Accurate Drill Positioning— FAST!

New, positive mechanical-action Bux radial positioner assures faster, accurate alignment of Bux portable magnetic drill presses. Magnetic base remains stationary, safely holding unit to work on any *overhead* or *vertical* flat working surface. Full 330° positioning rotation. Lateral movement provided assures precision positioning for drilling, reaming, tapping. Available on Bux magnetic drill press models L-2RP and L-3RP.

LIFTING MAGNET

Cap. 3000 + lbs

by BUX

FEATURES:

- Absolutely Permanent Ceramic Magnets
- Lifts better than 3000 lbs
- 6½" x 13" lifting face
- Needs no wires (electric)
- Never needs "recharging"
- Magnet cannot be turned off when in use.
- No wet batteries or acid

BUX magnetic products
A Subsidiary of O. S. Walker Co.

BUCK MFG. CO.
P.O. Box 692
1355 North 10th St.
San Jose, Cal.

VISIT OUR BOOTH
DETROIT '60 APRIL 21-28
ASTE TOOL SHOW

Walker 2242

AT THE SHOW-

NEW!

CERAMAX ROTARY CHUCK

with Ceramic Magnets for Turning and Grinding

New Ceramax Rotary chucks with permanent ceramic magnets are powerful enough for safe rugged lathe work as well as grinding. All *steel* top plate construction. Variable holding for easy work positioning. Simplified spindle mounting has no collector rings or brush units. In the locked ON position, chuck will *not* demagnetize. Rotationally balanced whether in "ON" or "FREE" position. Available in sizes from 4" to 12" diameters.

O.S. Walker

O. S. WALKER CO. INC., WORCESTER, MASS.

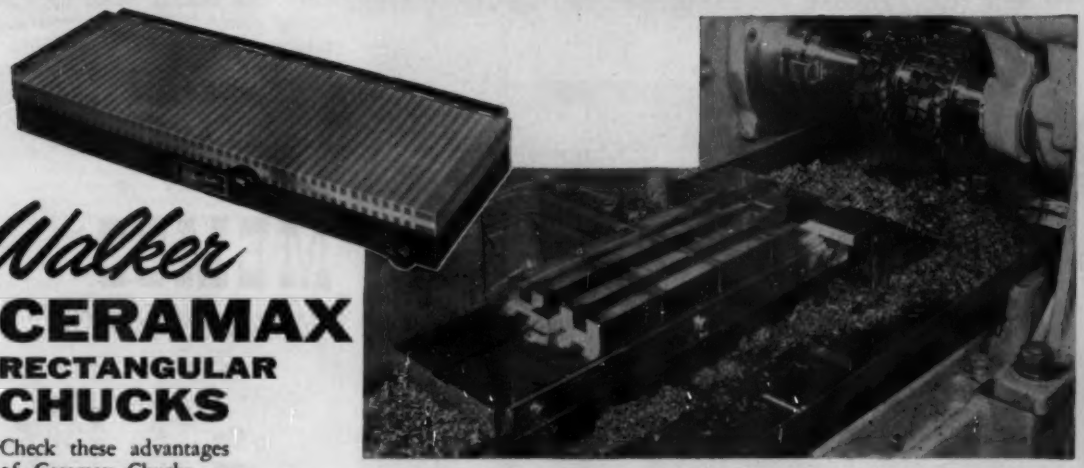
Original Designers & Builders of Magnetic Chucks

VISIT OUR BOOTH * '60 ASTE TOOL SHOW DETROIT APRIL 21-26

Walker 2242

VISIT OUR BOOTH * '60 ASTE TOOL SHOW DETROIT APRIL 21-26

Walker 2242



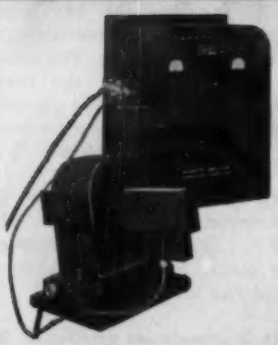
Walker CERAMAX RECTANGULAR CHUCKS

Check these advantages of Ceramax Chucks —

- Holding power extends to periphery of chuck.
- Silver brazed all-steel top plate.
- No magnetism imparted to work; chips and grit fall freely from work surface.
- No soft gap strips in which chips become imbedded — eliminates constant redressing.
- Three times coercive force of ordinary Alnico magnets.
- ¼" pole spacing.
- Low in height for greater machine capacity.
- Sizes from 4" x 4" to 12" x 24".

NO MATTER HOW COMPLEX YOUR PROBLEM

Walker has the know-how to solve it!



Here are three typical instances of how O. S. Walker, can solve unusual problems for customers.

Above — A large three faced electro magnetic chuck measuring 13½" x 22" x 158" especially built for the knife grinding industry.

At right — A 96" diameter rotary auxiliary plate being prepared for production.

Above — An example of Walker engineered demagnetization — a special Saturable Reactor Control Demagnetizer for ball bearings.

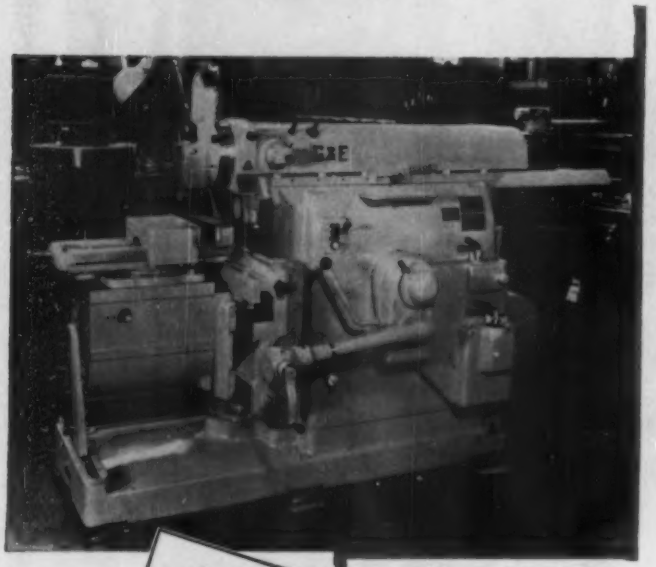
O. S. Walker

O. S. WALKER CO. INC., WORCESTER, MASS.

Original Designers & Builders of Magnetic Chucks

Can You Hold Your Shaper Without Bolts?

YES- with new WEDGMOUNT which anchors Shapers, Presses, etc. *and* permits precision leveling!



Free folder gives complete facts about **WEDGMOUNT** with—

"Air-Loc" patented vinyl, sisal and cork pads top and bottom grip machines to floors

•

double-wedge construction which permits immediate precision leveling

•

keyed construction which prevents movement within the mount

•

sizes available thru distributors, and prices

This Gould & Eberhardt 24″ Industrial Universal Shaper, operating at 120 cuts per minute with a 4″ stroke, is installed without bolts on a new type machinery mount called WEDGMOUNT. A dial indicator at the base of the shaper showed a total oscillation of only .022″ during operation, and no "walking." The 7,800 lb machine is installed on six WEDGMOUNTS, each type 3″ x 6″ S. Before operation, precision leveling is achieved by simple adjustment of a bolt within each mount. Top and bottom of each mount is surfaced with patented "Air-Loc" pads, which provide the high degree of friction required to hold the machine in place despite its strong lateral thrust, and greatly reduce transmitted vibration.

Air-Loc® WEDGMOUNT
4-17-4

write to... **Clark-Cutler-McDermott Co.**
100 West Central Street • Franklin • Massachusetts

Birdsboro Gets Contract to Build Republic Steel Tube Sizing Mill

Birdsboro Corp, Birdsboro, Pa, has received a contract to build a three-stand tube sizing mill for the South Chicago Works of Republic Steel Corp. The mill, powered by a 500-hp ac motor, will warm roll P-110 tubing in sizes from 4½ to 10¾ in. dia. The center stand of the mill will have an overhead pinion housing capable of swinging out 90° for easy maintenance.

MEMOS

by BESS RITTER

That old phrase, "an axe to grind," really did originally refer to an axe, and was coined shortly after an essay entitled "Who'll Turn the Grindstone?" appeared in print.

It involves a boy who was asked by a stranger, "Will you let me grind my axe on your father's grindstone?" The boy was told what a fine fellow he was, and the compliments rained down on him so thick and fast that before he realized what was happening, he was blistering his hands keeping the grindstone in motion while the stranger sharpened his axe. The schoolbell rang, but the boy kept working because the gentleman's flatteries were so pleasing. The minute the axe was sharp, the man frowned and told the "little rascal" to "scud to school" because he was nothing but a "clumsy truant."

The story concluded with the moral that whenever our young hero "afterward . . . saw one person flattering any other, he said to himself, 'that man has an axe to grind!'"

This tale is sometimes attributed to Benjamin Franklin, but was really written by a man who was named Charles Miner. It was published in a Pennsylvania country newspaper sometime in the early 1800's.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 BORING, TURNING, AND FACING MACHINES—*American Electronics Inc, Industrial Machinery Div, 9C Broadway, Norwood, Mass.* 8-page brochure and 36-page operational manual describe new line of single, twin, and opposed spindle units guaranteed to provide repetitive accuracies to 50 millionths. With standard tools, machines provide up to 9 operations in one automatic cycle. Manual illustrates how typical operations may be performed on all three units. Includes specifications, plant layout data, setup instructions, and accessory equipment.

2 HYDRAULIC TRACER MILL—*Famco Machine Co, 3100 Sheridan Rd, Kenosha, Wis.* 8-page catalog contains illustrated information on wide variety of work that can be done on units that range from completely automatic to manual available in one, two, and three-dimensional models.

3 HIGH - SPEED FORMING MACHINES — *Cyril Bath Co, 22215 Aurora Rd, Solon, Ohio.* 15-page catalog pictures and describes three new machines that utilize many of the techniques and advantages in radial draw, stretch and compression forming. Parts produced are illustrated together with production, tooling, and material savings.

4 ELECTROLYTIC CARBIDE TOOL GRINDER—*Everite Machine Products Co, 2005 E Huntingdon St, Philadelphia 25, Pa.* 4-page illustrated brochure describes the Electrochemical Machine Tool Model H-4 that combines off-hand and chipbreaker grinding facilities in one machine and is supplied with an inbuilt dc power supply unit of 300 amp capacity. Because the off-hand table oscillates rather than the spindle, machine can be used for simultaneous off-hand and chipbreaker grinding.

5 UNITIZED BROACHING FIXTURES—*National Broach & Machine Co, 5600 S Jean Ave, Detroit 13, Mich.* 12-page illustrated catalog B60-1 presents information on a variety of Red Ring self-

"I asked for a bigger pay envelope. I guess I should have asked for more money."

DON'T PAMPER THESE TAPS

....they can take it!

Hanson-Whitney has now standardized its line of Taps for "off-the-shelf" selection with all types and sizes measuring up to the most exacting requirements.

These Taps can be used at high speed operation on the difficult modern metals required in today's production.

H-W products are stocked by leading Distributors, with Technical Engineering Service readily available.

Write for the NEW Hanson-Whitney Tap Selector showing how to quickly make the proper tap selection. It's free!

THE Hanson-Whitney COMPANY

169 BARTHOLOMEW AVENUE • HARTFORD 2, CONNECTICUT

TAPS • GAGES • COMPARATORS • HOBS • CUTTERS

new GREAVES 2-XH Milling Machines

More power at the cutters

The completely new GREAVES No. 2-XH Milling Machine brings added versatility, increased operational ease, and more power where it's needed most . . . *at the cutter!*
It utilizes two motors, one for spindle drive; a separate motor for moving table, saddle and knee. Compare this and the other outstanding features of the new Greaves Mill. You'll see why Greaves is "The MOST Mill for the LEAST Money."

Write for detailed literature!

- Wide range of speed/feed combinations for any type material, any type job.
- Heavy, internally ribbed column casting and heavy duty rectangular overarm for maximum rigidity.
- Large, heavy-duty knee, saddle and table provide accuracy for all types of milling.
- New 7½ HP spindle drive motor, with separate motor for movable components, provides extra power for heavy milling.
- Easy-to-reach controls. Handwheels and vertical crank disengage automatically when not in use.
- New rapid traverse lever within operating control area.
- Separate drive motor for table, saddle and knee provides more smooth balanced power at the cutter.

GREAVES

J. A. FAY & EGAN COMPANY
2100 Eastern Avenue, Cincinnati 2, Ohio

CIRCLE 281 READER SERVICE CARD

ADDITIONAL MARKET DATA AVAILABLE FROM THE AMERICAN MACHINIST / METALWORKING MANUFACTURING INVENTORY

Statistics collected for American Machinist / Metalworking Manufacturing's unique census of metalworking equipment have been tabulated on IBM cards. Special runs to fit the inventory to your needs are now possible for a nominal fee. Write for complete information.

American Machinist / Metalworking Manufacturing
Market Dept.
330 W. 42nd ST., N. Y. 36, N. Y.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

contained, air-powered units for producing keyways, slots, flats, small splines, oil grooves, serrations, deburred surfaces, and holes of various shapes. Complete production data included for each application.

6 PRECISION SPINDLES—*Pope Machinery Corp, 261 River St, Haverhill, Mass.* Pocket-size 36-page bulletin S-18 pictures and describes over 60 different types for grinding, boring, milling, slotting, and drilling, including the newest high frequency spindles and Anocut spindles arranged for electrolytic grinding. Also gives specifications on two new Super-Precision boring machines, and new line of custom-built driving motors.

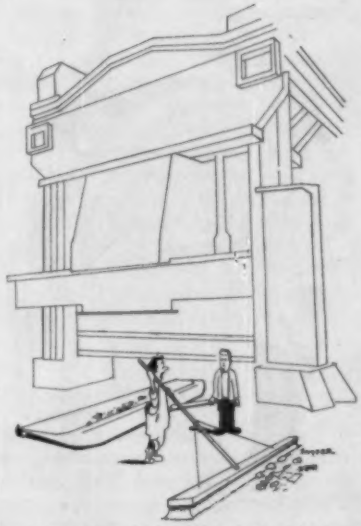
TOOLS AND ACCESSORIES

7 INSERTS, BLANKS, TOOLS—*Wesson Co, 1220 Woodward Heights Blvd, Ferndale 20, Mich.* 36-page bulletin MF-260 describes standard lines of carbide throw-away and on-end inserts, blanks, and brazed single-point tools. Specifications given on square, round, triangular, and diamond shaped items. Technical data included for various grades of Wessonmetal carbide.

8 CAST ALLOY CUTTING TOOLS—*Crobalt Inc, 2800 S State St, Ann Arbor, Mich.* Catalog details special advantages of Crobalt tooling, various grades of tools available with specifications and diagrams of each. Covers toolbits, cutoff blades, inserts for vertical toolholders, and special inserted-tooth milling, boring, and reaming blades.

9 CUTTERS FOR HYDRAULIC FITTINGS—*Wetmore Tool & Engineering Co, 5320 E Washington Blvd, Los Angeles 22, Calif.* 32-page catalog describes and gives prices for Economy Models AND 10050 port contour cutters in sizes for ¼ through 2-in. OD tubing. Other types of standard cutters for hydraulic fittings covered.

10 CLAMPS, JIGS, AND FIXTURE COMPONENTS—*Lodding Inc, 16921 W Eight Mile Rd, Detroit 35, Mich.* 70-page catalog 20 contains engineering drawings in full size for tracing templets.



"Well I personally feel this efficiency business can be carried too far!"

Variable Speed Simplicity Economy

REEVES vari-speed **MOTOR PULLEY**

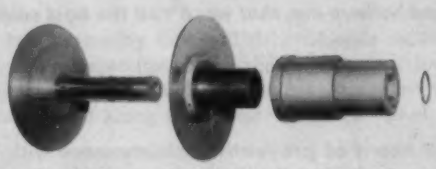
The obvious advantages you gain from this Reeves Motor Pulley design are accurate variable speed control, low cost operation, no problems.

It's as simple as this: There are two smooth-faced cone-shaped discs, one mounted in fixed position on the motor shaft, the other designed to slide laterally on the hub of the fixed disc. Belt tension spring automatically maintains pressure on the sliding disc for correct belt tension at all output speeds, while smooth, stepless speed changes are accomplished by adjusting the sliding motor base.

Disc Assemblies are available in nine sizes, ⅓ hp. through 15 hp. to fit either old or new NEMA motors. Speed ranges up to 4:1. Separately mounted countershaft assemblies are available to match any of your machine speed requirements. Your Reliance Sales Engineer has all the facts. Call him . . . or if you prefer, write for Bulletin No. GV-582-1.

G-1050

ONLY 3 MAIN PARTS!



Fixed Disc Sliding Disc Belt Tension Spring

ONE LUBRICATION POINT!

Reeves exclusive "Close Grooving" maintains a film of lubricant between hub length of fixed disc and bore of sliding disc . . . prevents sticking.

Product of the combined resources of Reliance Electric and Engineering Company and its Reeves and Master Divisions

RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 14A, CLEVELAND 17, OHIO
Canadian Division: Toronto, Ontario
Sales Offices and Distributors in Principal Cities

Duty Master A-c. Motors, Master Gearmotors, Reeves Drives, V★S Drives, Super 'T' D-c. Motors, Generators, Controls and Engineered Drive Systems.

TORIT DUST COLLECTION ENDS THIS:

"OUT OF PRODUCTION FOR THREE DAYS? THAT'S WHEN WE'RE SUPPOSED TO SHIP!"

"And believe me, that wasn't all the boss said! Two key machines were so clogged with dirt and grime we had to disassemble and clean them—overnight! Between overtime for the repair crew and our own crew, I managed a partial shipment in three days. And I made up my mind this wasn't going to happen again!

"I'd heard of preventive maintenance with Torit Dust Control equipment—and the Torit representative I called sure opened my eyes! Clean machines hold close tolerances better and up to 80% longer! Torit collectors remove over 99% of dust and air-borne debris, save on both the cost and frequency of servicing.

"I expected there'd be a hitch on prices—but look what I found out: our production breakdown cost nearly as much as the Torit equipment we needed! And just while Torit Dust Collectors are being depreciated we'll make money on them —through maintenance savings, improved production, and reduced down-time!

"The boss actually congratulated me when I showed him the savings Torit preventive maintenance gives us!"

Torit Dust Collectors stop dust build-up before it costs you money. They're available in both high efficiency cyclone and cabinet type units. Why not check into them today—write:

TORIT manufacturing company

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

11 LUBRICANT—*Alpha-Molykote Corp, 65 Harvard Ave, Stamford, Conn.* 4-page bulletin 126B describes Molykote Type G, a grease-consistency product that reduces galling, seizing, and metal pickup in high pressure and high temperature applications. Typical uses include machine wear-in, fretting, threading connections, highly loaded gears, cold metal forming, and press fitting. Small sample tube available.

12 VAPOR GENERATOR—*Associated Technical Sales Co, 3629 N Dixie Drive, Dayton, Ohio.* Illustrated brochure provides data on the Coolie-Toolie which removes heat from tools and machine surfaces in cutting, grinding, milling, and similar operations. Includes product description, suggested applications, plus information on multi-line units and Coolie Coolant Concentrate.

13 COUNTERSINKING — *Cleveland Twist Drill Co, 1242 E 49th St, Cleveland 14, Ohio.* 4-page folder discusses important factors in the process, recommends types of countersinks to use in various materials for both portable and machine work, and gives information on regrinding. Illustrates and describes four types of Cleveland New Style countersinks.

14 GAGING EQUIPMENT—*Taft-Peirce Manufacturing Co, Woonsocket, RI.* 12-page new price list 216 B-2 also contains tabular data on sizes and threads per inch for variety of gages; covers thread measuring wires and electrolized gages.

15 RECESSING TOOL DATA FILE—*Maxwell Industries Inc, 493 E 5th St, Ashtabula, Ohio.* 6-page data file AT-61 aids in selecting proper recess toolholder for internal machining work, shows how such operations can be efficiently performed with company's line of 27 standard models of recessing tools without resorting to any special tool designs. Five basic groups of recess toolholders are cataloged with general use for specific model, the feed ratios, throw, and individual production advantages.

16 COMPARATOR—*Mueller Gages Co, 1052-1058 N Allen Ave, Pasadena, Calif.* 2-page bulletin describes the Mikrom comparator that has as standard equipment carbide measuring balls, backstops,

(continued on p 192)

"Er . . . friend . . . pal . . . buddy . . ."

TAKE A CLOSE LOOK AT YOUR "HOLE COST" SITUATION

The costs of producing sheet metal parts vary greatly—but one fact stands out. Holes can be pierced in short run work at the lowest cost with a Wiedemann Turret Punch Press.

Wiedemann savings of 60% to 90% are commonplace throughout industry. These are possible because a Wiedemann combines:

1. the speed of a punch press.
2. low cost punches and dies in turrets ready for use without setup.
3. a quick setting mechanical work positioning gauge.

Find out how a Wiedemann will reduce your "hole costs." Send drawings of your work for time study and write for Bulletin 201.

MMT=PE
Machine Tool Exposition
Chicago Sept. 6-16

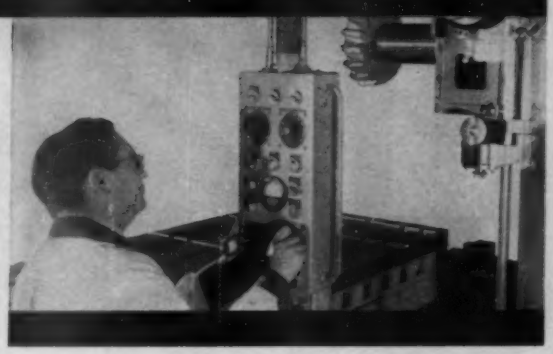
SEE WIEDEMANN PRESSES FROM THE HAND OPERATED R-2 TO THE TAPE-CONTROLLED WIEDEMATIC IN OPERATION . . . BOOTH 1249

WIEDEMANN
MACHINE COMPANY
TURRET PUNCH PRESSES

DEPT. AM-4 • GULPH ROAD • KING OF PRUSSIA, PA.

A HORIZONTAL IN A CLASS BY ITSELF

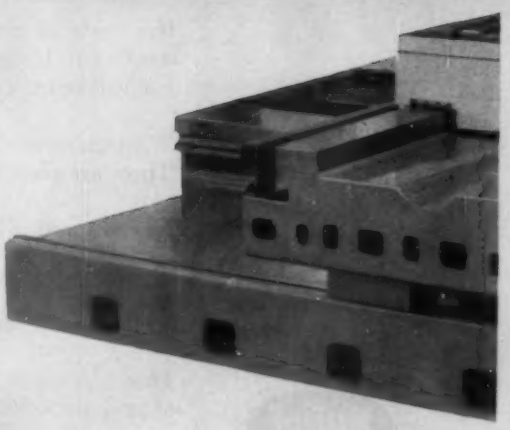
ALL-NEW GIDDINGS & LEWIS IS EVERY INCH A 6" SPINDLE MACHINE (ALSO AVAILABLE WITH 5" SPINDLE)



The voice of the customer was heard when this machine was designed! The finest in the history of a fine line of machines, the all-new GIDDINGS & LEWIS heavy-duty horizontal offers every feature and advantage sought in modern-day machining.

In a class by itself, it is constructed and powered as a 6" spindle machine, but also is available with 5" spindle in a size, weight, and price range competitive to other 5" machines . . . completely pendant controlled.

It offers versatility and ease of operation never before equaled in a horizontal. It is capable of taking heavy milling cuts and yet of delivering jig bore accuracy on precision boring, drilling, reaming, and tapping. It is designed for optimum production with carbide and ceramic tooling on work ranging from large-diameter boring and facing to small-diameter drilling.



Features that put more work on the floor, every day

Complete pendant control with preselection of spindle feeds and speeds frees the operator to watch the work.

Joy-stick directional control for milling feeds and rapid traverse to headstock and table — moving the stick at any of four 45° angles moves headstock and table simultaneously in desired directions.

Remote clamping of head, table, saddle, and spindle lets the operator stay in one place to get more done.

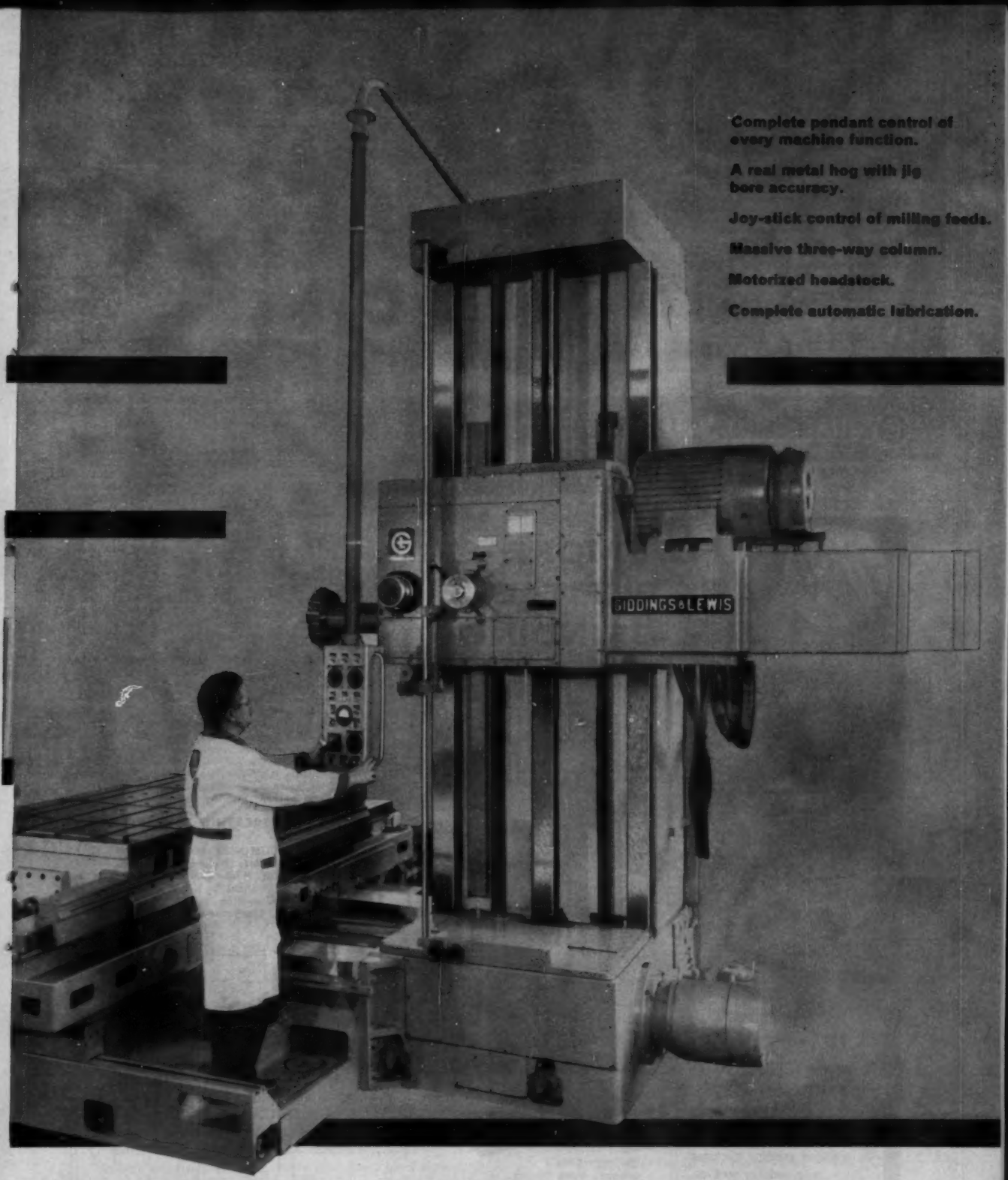
Motorized headstock provides more power for chip removal and eliminates external high-speed spinning shafts.

Massive three-way column provides inflexible stability for maximum horsepower milling and boring.

These are just a few of the new values in what is truly the most versatile high-power precision horizontal boring, drilling, and milling machine ever offered to the metalworking industry. One look at its clean uncluttered design tells you that here is unequaled rigidity, power, and precision — unequaled capability for high performance and profitable production.

For all the facts about the horizontal that's in a class by itself, send for new Catalog No. H6T. Call your local GIDDINGS & LEWIS representative or write to the factory.

CIRCLE 286 READER SERVICE CARD


Complete pendant control of every machine function.
A real metal hog with jig bore accuracy.
Joy-stick control of milling feeds.
Massive three-way column.
Motorized headstock.
Complete automatic lubrication.
GIDDINGS & LEWIS

GIDDINGS & LEWIS

GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond Du Lac, Wis.

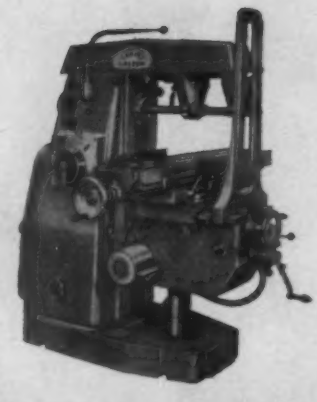
Horizontal boring, drilling, and milling machines; vertical turret lathes; vertical boring mills; positioning tables; die sinking machines; contour milling machines; radial and upright drilling machines; planers; planer mills; numerical and tracer control systems; Davis boring tools.

CIRCLE 287 READER SERVICE CARD

PAINSTAKING ATTENTION TO DETAIL characterizes SAJO Millers

exemplified by the unsurpassed SAJO spindle construction employing double-row staggered roller bearings and ball thrust bearings — assures utmost stability and smooth transmission of full horsepower to cutter.

Available as
Plain, Universal & Vertical Millers.
Productisa Millers with automatic cycling.



No. 2 Universal Miller
table size: 52" x 11"
7½ and 1½ HP motors,
rapid power traverse.

austin industrial corporation

76-F Mamaroneck Avenue White Plains, New York

CIRCLE 297 READER SERVICE CARD

MSO Since 1865

FOR MORE PROFITABLE GRINDING

For toolroom or job shop this MSO Universal Grinder with 7" x 12" capacity is unexcelled in sensitivity, accuracy, finish.

MODEL FMES
a true Universal Grinder
with compound swivel
wheelhead
fine in-feed to .00005"

Whether for toolroom or production, MSO offers a complete line of precision grinding machines with features such as:

Automatic cycling
+ Precimatic sizing
+ Electronic Match Grinding

WRITE FOR LITERATURE ASK FOR REFERENCES

When only the best will do, check MSO first

austin industrial corporation

76-F Mamaroneck Avenue White Plains, New York

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

lifting levers, threaded columns for fast adjustment, and fine and extra fine zero adjustments. Mikrom heads are interchangeable so that one stand can be used to accommodate all.

17 PUNCH AND DIE BUTTON RETAINERS—*Atlantic Tool & Die Co, Special Products Div, 1374 W 117th St, Cleveland 7, Ohio.* 4-page bulletin illustrates and describes ball-lock retainers; die buttons with Split tapered halves; contour punches ground in the direction of the working motion for reduced stripping friction. Retainers are available in standard duty and heavy duty types, made to exact specifications in round, square, rectangular, or odd shapes.

18 DIAMOND DRILLING EQUIPMENT—*Wheel Trueing Tool Co, Truco Masonry Drilling Div, 2200 W Davison, Detroit 38, Mich.* Literature covers diamond drilling machines, diamond drill bits and accessories, Truco concrete, masonry and stone saws and diamond blades. Descriptions and specifications given for complete line of drilling and sawing tools and hints on how to reduce drilling costs.

19 RUBBERIZED ABRASIVES—*Crates Manufacturing Co, 1800 Rollins Rd, Burlingame, Calif.* Application manual includes information on many uses for rubberized abrasives, case histories on a variety of typical applications, and a copy of the latest catalog. Most efficient methods for mounting, dressing, and truing, and recommended operating speeds given.

20 HACKSAW BLADES—*Atkins Saw Division, Borg-Warner Corp, Indianapolis 25, Ind.* Descriptive literature on Silver Streak HSS hacksaw blades contains tables of recommendations for speed and feed of power saws; types of saws and teeth to use for various metals; tips on use of hand hacksaws, and illustrations and specifications for complete line of metal cutting blades. Also covers Silver Steel Tungsten blades, standard hand hack blades, and hacksaw frames.

HEAT TREATING AND WELDING

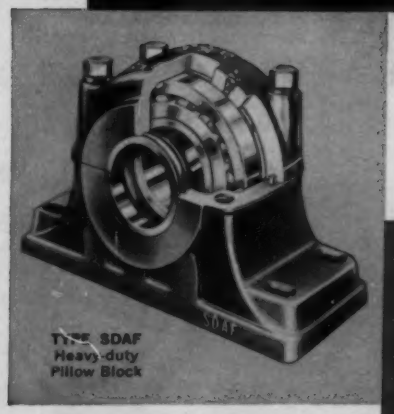
21 ALUMINUM JOINING MANUAL—*All-State Welding Alloys Co, 249-55 Ferris Ave, White Plains, NY.* 40-page illustrated manual is a complete survey of aluminum welding, brazing, and soldering.

(continued on page 196)

"My office door is always open—but don't let that fool you — it's so I can keep my eye on you!"

TYPE SAF
Ball or Spherical Roller
Bearing Pillow Block

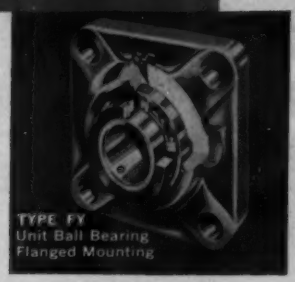
Can you get these "special" qualities in "standard" pillow blocks?



TYPE SDAF
Heavy-duty
Pillow Block

TYPE SY
Unit Ball Bearing
Pillow Block

TYPE SES
Unit Rubber-Ser Ball
Bearing Pillow Block



TYPE FY
Unit Ball Bearing
Flanged Mounting

Most pillow blocks offer easy assembly and rugged housings. But can they offer you low friction, self-aligning bearing operation and efficient sealing as well?

They can—if they're the SKF pillow blocks, and flanged mounting, shown here. Type SAF, for example, comes equipped with low-friction ball or spherical roller bearings that are *inherently* self aligning. And these bearings are effectively protected by Triple-Seal rotating rings. Abrasives and corrosives can't get to them—oil or grease can't drip out.

Yet this is a standard SKF pillow block, that is competitively priced in spite of its combination of extra features. We make it for shaft sizes from ¼" to 10½", for mounting directly or with an adapter. A cast steel housing (SAFS) is available for heavy duty applications.

For details, call one of our twenty-four offices. 5938

Spherical, Cylindrical, Ball, Tyson® Tapered and REED Miniature Bearings

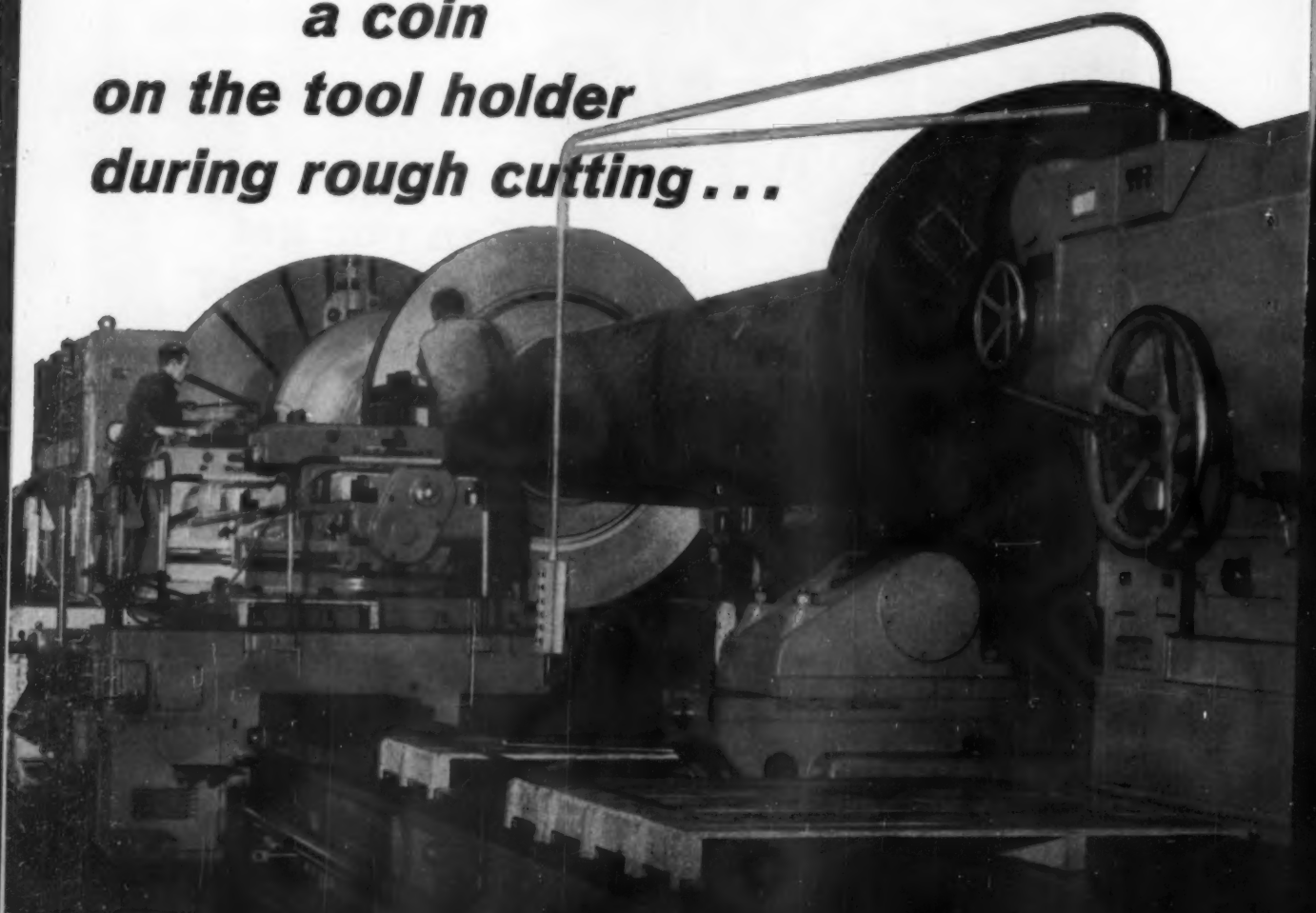
EVERY TYPE—EVERY USE

SKF®

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

®REG. U.S. PAT. OFF.

you can balance a coin on the tool holder during rough cutting...



on this

waldrich high speed lathe

Series WSD

- Rigid construction insures vibration-free operation with carbide tools.
- Maximum utilization of horsepower in main drive
- Rugged headstock
- Heavy duty tail stock
- 3-way and 4-way bed design
- Fast, efficient chip collecting

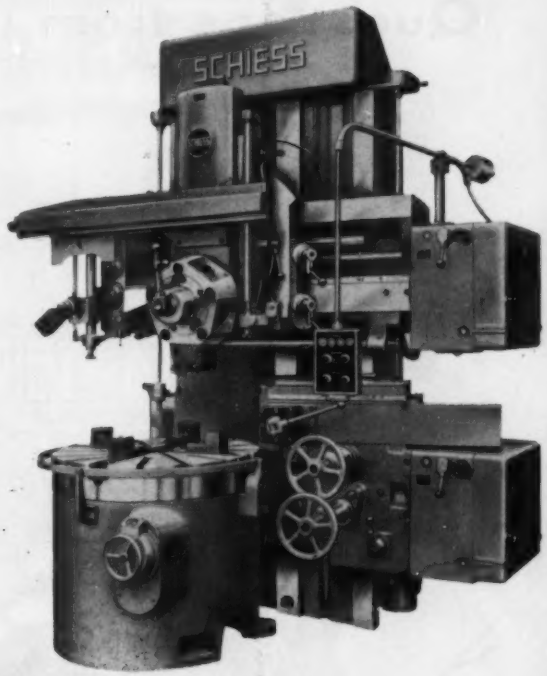
Write for details today.

WALDRICH SIEGEN

american waldrich mfg. corp.

1232 PENN AVENUE, PITTSBURGH 22, PENNSYLVANIA

Model KE Single Column Vertical Turret Lathes with 40", 50" and 65" turning diameters for high-speed carbide machining.



Hydraulic pre-selection of speeds set by handwheel and read on illuminated dial. 16 spindle speeds—ratio 1:50—up to 310 rpm for carbide machining on Model KE 100. Table runs on tapered roller bearings.

Fingertip control for direction of feed and rapid traverse with spring-loaded mono-levers for normal direction plus angular compound feeds. Mono-levers move in same direction as desired feed or traverse movement, simplify correct setting by operator. Specially designed electro-magnetic disc clutches disengage feed instantly with no over-riding or coasting.

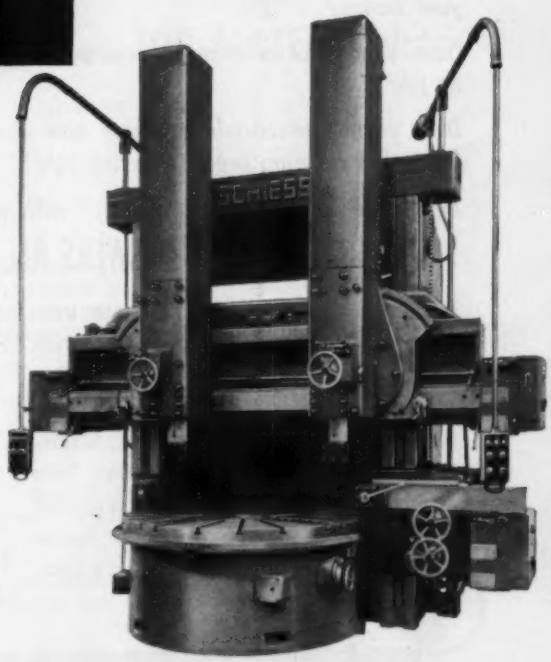
Counterbalanced cross rail and side head. Single lever unlocks, raises or lowers, and locks cross rail simultaneously by electro-mechanical controls. *No bolts or nuts to loosen or tighten by hand.*

Slip ring motor provides smooth "load sensitive" acceleration and braking. Variable speed as well as constant cutting speed available. Motor mounted on left side of machine with separate control enclosure. Fingertip control assured by pendant mounting of all necessary control functions. Electrics supplied from all U. S. manufacturers.

Copying attachment with electric tracer for use on cross rail or side head.

See why tool engineers call these heavy producers, "MOST MODERN MACHINES OF THEIR TYPE"

Model KZ Double Column Vertical Boring Mills with 65", 80", 98" and 118" turning diameters.



All operating features of KE Series Vertical Turret Lathes are combined in

SCHIESS KZ DOUBLE COLUMN VERTICAL BORING MILLS, PLUS—

Heads equipped with steel octagon rams can be swiveled—have automatic feed in vertical, horizontal and angular direction and are independent of one another as to amounts and direction of feed. Table, feed and rapid traverse controls are all contained in the pendant station. Standard model KZ Double Column Vertical Boring Mills are available with 65", 80", 98" and 118" turning diameters.

Get to know these products of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess engineer will be ready to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on these and other Schiess equipment.

SCHIESS

AMERICAN SCHIESS CORPORATION

1232 Penn Avenue, Pittsburgh 22, Pa.

CIRCLE 291 READER SERVICE CARD

Questions from the floor

Are you getting most floor absorbent bulk (not weight!) for your money?

Does your floor absorbent become saturated before it does its job?

Does your floor absorbent create new hazards by absorbing light, thus reducing needed working light?

Does your floor absorbent "mud up" with oil and water?

THERE'S A TEST THAT ANSWERS ALL THESE QUESTIONS

In less than 15 minutes in your own office, you can get all the right answers scientifically. Our Eagle-Picher representative will bring a miniature laboratory right to your desk. Compare Eagle-Picher Floor-Dry with any other floor absorbent. See which wins out on overall economy and full-range safety. Eagle-Picher is eager to face comparative tests. Write today.

Since 1843

EAGLE PICHER

EAGLE-PICHER

The Eagle-Picher Company
Dept. AM 4-18, Cincinnati 1, Ohio

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

Covers welding aluminum and its alloys by inert gas shielded metal arc with a consumable electrode, tungsten electrode, and the latest arc and gas welding processes. Includes chapters on brazing, description of aluminum brazing alloys, cleaning and finishing after brazing, and charts of brazeable aluminum alloys. Soldering section includes melt and flow charts, how to solder aluminum to other metals, and instructions on aluminum soldering with torch or iron, with or without flux. Also included are 12 charts on composition of aluminum alloys, technical and physical properties, recommended filler alloys for MIG and TIG welding.

22 MULTI-SPOT AND PROJECTION WELDERS — *Taylor-Winfield Corp, Warren, Ohio.* 12-page brochure S-413 describes 32 multi-spot and projection resistance welding machines in detail. Covers end product, type of operation, production rate, welding machine specifications, and material handling equipment. Data on automatic loading; inspection; special welding techniques; spot, projection, and seam welds; resistance brazing and hot upsetting operations; automatic transfer; associated forming operations; and automatic unloading.

23 HYDROGEN ATMOSPHERE HAND PUSHER FURNACES — *Lindberg Engineering Co, 2450 W Hubbard St, Chicago 12, Ill.* Illustrated bulletin 260 describes full muffle unit for bright hardening and annealing of stainless steels and other high alloy materials. Contains a furnace cutaway drawing with dimensions and a chart of specifications for both the electric and gas types.

24 FURNACES — *Sunbeam Equipment Corp, 180 Mercer St, Meadville, Pa.* 6-page bulletin illustrates full line of industrial furnace equipment for heat processing. Chart simplifies selection of proper type of furnace for 19 applications.

25 ELECTRODES — *National Cylinder Gas Division of Chemetron Corp, 840 N Michigan Ave, Chicago 11, Ill.* Seven data sheets for Sureweld ac and dc electrodes cover four for use in mild steel welding, one for medium carbon steel, one for high carbon steel, and one for railwear. Welding characteristics, recommended current ranges, welding or surfacing procedures, and the physical properties of deposited metal are given.

26 TEMPERATURE DETERMINERS —*Tempil® Corp, 132 W 22nd St, New York 11, NY.* Newly revised "Instructions for Using Tempilstiks®" lists complete line including new temperature ratings. Data sheet discusses checking temperatures of rotating parts; how to obtain the temperature distribution of a surface; visibility on brightly radiating hot surfaces; checking temperature of a cooling object; effects of reducing atmospheres and electrical fields.

27 SAFEGUARDS FOR WELDERS— *Sellstrom Manufacturing Co, Palatine, Ill.* 28-page catalog 36 on complete line of eye and face protection equipment gives illustrated descriptions of goggles, glasses, helmets, face shields, lenses, respirators, and similar products.

PLANT SERVICE EQUIPMENT

28 LOW VOLTAGE DISTRIBUTION EQUIPMENT—*General Electric Co, Distribution Unit, Plainville, Conn.* 1960 edition of the 84-page Buy Log is a condensed buying catalog that covers service entrance equipment, light and heavy duty

safety switches, tumbler and open-knife switches, hinged wireaway, circuit breakers, switchboards, motor control centers, sectional distribution centers, and all types of panelboards and busway. Includes selector charts for each type of product, ratings, weights, dimensions, and general application information.

29 ULTRASONIC CLEANING AND RUST-PROOFING LIQUIDS—*Rust-Lick Inc, 755 Boylston St, Boston 16, Mass.* 9-page folder covers line of new products developed to meet the requirements of an integrated ultrasonic cleaning and rust-proofing system. Ultrasonic Liquid Cleaning Concentrate 660-J described, and the factors involved in selection of rust preventives for use after cleaning are explained.

30 HAND-OPERATED HYDRAULIC PUMP—*Sheffer Corp, 220 W Wyoming Ave, Cincinnati 15, Ohio.* 4-page bulletin 160 describes single acting unit of near aircraft quality (priced at $39.95) that is supplied with vertical or horizontal handle socket for operation where head space is limited. Unit is available for 1000, 2500, or 5000-psi operation with displacements of 0.9 0.4, an 0.17 cu in. per stroke with 18-in. handle when force of 60 lb is applied.

31 INDUSTRIAL TRUCK COST CALCULATOR — *Lead Industries Association, 60 E 42nd St, New York 17, NY.* 12-page brochure makes it possible to estimate in minutes the costs incurred by industrial trucks. Alignment charts show costs of depreciation, operation, and maintenance for both gasoline-powered and battery-powered vehicles.

32 LIGHTING EQUIPMENT — *RLM Standards Institute Inc, 326 Madison St, Chicago 6, Ill.* 52-page 1960 edition of the RLM Standard Specifications book for industrial lighting units, in addition to three news specifications, includes many upward revisions of existing specs, including new high specs for materials; new specs for aluminum reflectors, and added provisions for inspection and testing.

PARTS AND MATERIALS

33 UNBRAKO SOCKET SCREW CATALOG AND ENGINEERING STANDARDS—*Standard Pressed Steel Co, Box 875, Jenkintown, Pa.* 82-page illustrated manual includes both standard catalog data and extensive design and performance information. The 2800 items covered include socket head cap screws, set screws, shoulder screws, button head screws,

"Say that was a catchy little word ya just used—where did ya pick it up?"

Close head room explosion-proof hoist, with hand geared trolley, bronze wheels and stainless steel tackle.

Give profits a lift...

with Shepard Niles JOB-MATED Hoists

It's the exact combination of capacity, clearance, speed and controls that makes this Shepard Niles Explosion Proof Hoist exactly right for your particular job. A hoist accurately matched to the job cuts handling costs, moves more materials faster, and gives longer service life.

And it's easy to match precise job conditions at Shepard Niles. With thousands of types and sizes of hoists to choose from, you are sure to find the **right** hoist for truly efficient, economical performance in your plant.

You have your choice of ¼-ton to 20-ton capacities; of floor or cab controls; motor-driven or hand-operated trolleys; regular or long lifts; and regular or close clearances. Whatever combination you choose, you get the quality construction and advanced engineering that have made Shepard Niles America's largest manufacturer of hoists and cranes.

For complete details on Shepard Niles **"Job-Mated"** hoists, write for a descriptive bulletin, or ask a Shepard Niles representative to call.

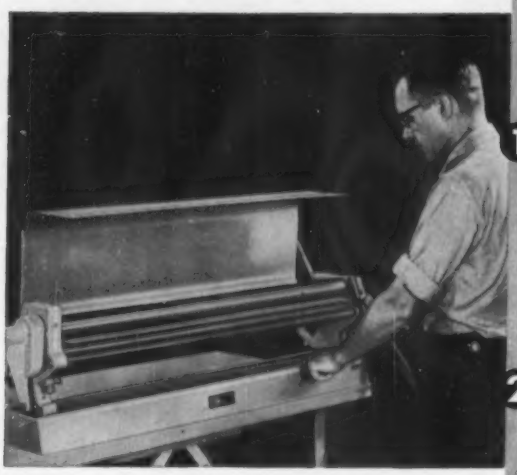
SHEPARD NILES
CRANE AND HOIST CORPORATION

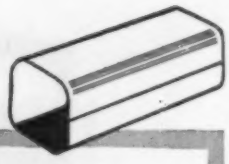
3108 Schuyler Ave., Montour Falls, N.Y., U.S.A.

HOW TO FORM

a rectangular shape with the

DI-ACRO ROLLER



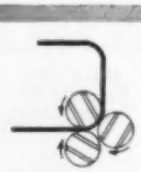


1 Introduce metal with Idler Roll disengaged.

2 Roll thru to desired point and engage Idler Roll.

3 Continue bend until angle is formed.

4 Disengage Idler Roll and roll to next point.



5 Engage Idler Roll to make second bend.

6 Repeat process until shape is formed.

Forming small and large circles without flat spots and a variety of other sheet metal shapes is easily accomplished on the Di-Acro Roller with its *exclusive cam actuated Idler Roll*. Rear roll indicators allow operator to quickly return to a previous setting. Eight models from 6" to 42" forming width.

See Di-Acro Machines in operation
Booth 805 ASTE Show, Detroit, April 21-28

NEW DI-ACRO POWER ROLLERS

Increase speed and efficiency. Forward, stop and reverse are governed by foot control leaving both hands free for feeding materials. Six sizes from 12" to 42" wide all with 2" ground and polished forming rolls.

For six page roller folder call your nearest Di-Acro dealer listed in the yellow pages under Machinery—Machine Tools or write to us.

pronounced *die-ack-ro*

di-acro PRECISION METALWORKING MACHINES

O'NEIL-IRWIN MFG. CO.

405 8th Avenue • Lake City, Minnesota

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

pressure plugs, and socket screw keys, square head set screws and dowel pins. Review of 24 different platings and surface treatments offered with recommended applications for each; check-list of the most common problems of fastener misfits, their cause, and means of detection is included.

34 FLAME SPRAY PROCESS—*Metallizing Engineering Co, 1101 Prospect Ave, Westbury, LI, NY.* 16-page bulletin provides engineering data on coatings of metals, ceramics, carbides, and other high melting point materials. Covers the metallizing process which sprays powdered metals, including tungsten carbide and self-fluxing alloys of the boron-silicon, nickel chromium type, and refractory ceramics, such as aluminum and zirconia; and the new METCO Plasma Flame Spray process which develops temperature up to 30,000 F and can spray any material that can be melted without decomposition.

35 NON-FERROUS METAL POWDER PARTS—*New Jersey Zinc Co, 160 Front St, New York 38, NY.* 24-page booklet contains useful data on the powder metal process and its uses; discusses compositions and properties of non-ferrous alloys, commercial tolerances, practical design suggestions and elements affecting costs. Applications section presents illustrated case histories of 27 selected examples showing uses of brass and nickel silver metal powder parts in different types of products.

36 MACHINABLE CARBIDES — *Chromalloy Corp, Sintercast Division, 122 Woodworth Ave, Yonkers 2, NY.* Bulletin 60 tabulates properties of two new stainless steel-bonded carbides. Called Ferro-Tic S, these compositions are formulated for applications requiring unusual corrosion resistance or strength at high temperatures as well as abrasion resistance and hardness. Because they are machinable, tools and components may be fabricated from blanks using conventional equipment, rather than diamond grinding wheels.

37 SHEAVES AND MOTOR BASES—*Browning Manufacturing Co, Maysville, Ky.* 8-page catalog SL-101-A illustrates and describes new line of spring loaded and manually controlled variable pitch sheaves and adjustable motor bases. Sheaves can be adapted to nearly any machine using a single V-belt; motor base provides an efficient means of center distance control. Includes tables of practical stock drive combinations.

38 GEAR MOTORS AND MOTOR REDUCERS — *Sterling Electric Motors Inc, 5401 Telegraph Rd, Los Angeles 22, Calif.* 8-page bulletin 198 illustrates and describes Slo-Speed gear motors and Slo-Speed separate motor reducers. Covers design, basic types and many modifications, as well as the universal mounting positions in which units may be used.

39 LIQUID COMPRESSIBLE DEVICES—*Taylor Devices Inc, North Tonawanda, NY.* 11-page engineering handbook CH illustrates and describes operation of Taylor Liquid Spring Shoks using liquid compressibility; provides nomographs and formulas so designer can determine the space reduction for a given force or energy using one of the devices. Pictures typical applications of range of devices up to 1.5 million pounds force.

40 AC MAGNETIC STARTERS—*Clark Controller Co, 1146 E 152nd St, Cleveland 10, Ohio.* 8-page illustrated bulletin PL 12-8-160 gives engineering data on Type CY starters available in a full range of sizes from 0 through 4. Clark

Arc Quenching Principle which provides greater contact life under heavy current loads and severe arcing conditions is described and diagrammed.

41 MOTORS—*Wagner Electric Corp, 6400 Plymouth Ave, St Louis 33, Mo.* 4-page bulletin MU-244 describes doubly protected drip-proof totally enclosed polyphase squirrel-cage units, 1 hp and larger, with NEMA C faceplates for close coupled centrifugal pump applications. 4-page bulletin MU-245 lists motors 1/6 through 10 hp available with resilient mountings. Units are designed for ultra quiet operation.

42 CAP SCREWS—*Set Screw & Mfg Co, Bartlett, Ill.* Illustrated bulletin provides specifications, dimensions, and other data on new 1960 series. Describes advantages and features and compares dimensions of both the new series and the old.

43 MACHINERY MOUNTS—*Unisorb, 210 South St, Boston 11, Mass.* 6-page bulletin describes three basic types: Unisorb Pads, Level-Rite, and Level-Rite UL; tells how they control vibration, permit easy machine relocation, and allow machines to operate at higher speeds. Includes data on loading ranges, vibration transmissibility, and how to use Unisorb cement.

● STRUCTURAL ADHESIVES — *Minnesota Mining & Manufacturing Co, Adhesives, Coatings, and Sealers Div, 900 Bush Ave, St Paul 6, Minn.* 16-page illustrated catalog contains detailed information on Scotch-Weld structural adhesives and structural adhesive design concepts, joint designs, and bonding methods. Technical information, tables, and line drawings deal with types and properties of film, one-part heat curing and two-part chemically curing adhesives; Case histories illustrate how these adhesives are used to solve structural assembly problems. Request direct on company letterhead.

44 MOLYBDENUM MILL PRODUCTS SPECIFICATIONS — *Universal-Cyclops Steel Corp, Refractomet Div, Bridgeville, Pa.* 22-page booklet covers unalloyed molybdenum and Mo-0.5 Ti alloy billets, bars, plates, and sheets. Material specifications for each of these standard mill products include scope, manufacture, chemical composition, structure, mechanical properties, dimensions, finish inspection.

45 RELAYS — *General Electric Co, Schenectady 5, NY.* 12-page bulletin GEA-7021 discusses complete line for all applications. Included are general purpose, machine tool, mechanically held (latched in), pneumatic time-delay, and synchronous motor-driven timing. Dimensions, ratings, application, and installation details included.

"All I said was, 'What's the matter, C.J.—they plug your loophole?'"

DISSTON HAS THE EDGE

10° positive rake angle cuts faster and smoother

The LANCER's 10° positive rake angle means each tooth cuts, not scrapes. The LANCER is exceptional for nonferrous metals, wood, and plastic. This hard-edge flexible back bandsaw blade cuts with hairline accuracy at maximum feeds. Cuts faster. Cuts smoother. Cuts more economically. Produces fully-formed chips. Clears them faster. Wears longer. Reduces downtime. See your industrial distributor, or write for free 6" sample blade to: *Disston Division H. K. Porter Company, Inc., Phila. 35, Pa.*

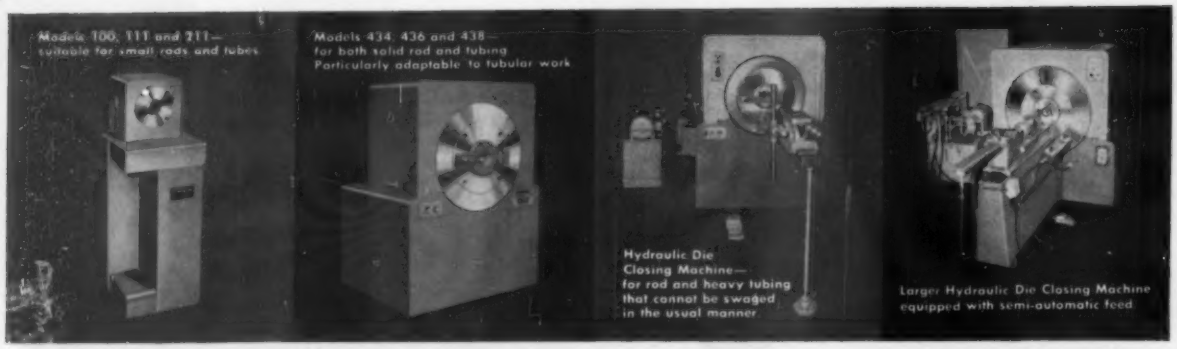
Specifications

Width	Gauge	Teeth Per Inch
¼"	23 (.025)	4, 6
⅜"	23 (.025)	4
½"	23 (.025)	3, 4
¾"	21 (.032)	2, 3
1"	20 (.035)	2, 3

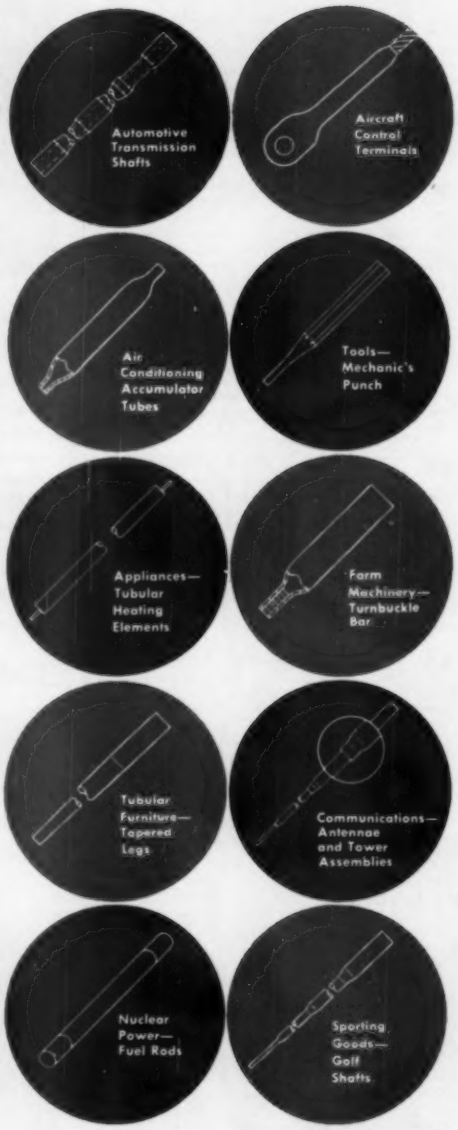
DISSTON PORTER DIVISION

H.K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.


Models 100, 111 and 211—
suitable for small rods and tubes
Models 434, 436 and 438—
for both solid rod and tubing
Particularly adaptable to tubular work
Hydraulic Die
Closing Machine—
for rod and heavy tubing
that cannot be swaged
in the usual manner
Larger Hydraulic Die Closing Machine
equipped with semi-automatic feed

TORRINGTON ROTARY SWAGING MACHINES DO JOBS LIKE THIS FASTER AT LOWER COST



Swaging is not only the fastest but also the most economical way to point, taper, reduce, size or bond thousands of small metal parts. You save on time, labor and materials—no stock is wasted. Tooling is simple and inexpensive.

Consider the variety of swaged metal parts illustrated here. If you are producing such parts by other means, you are probably paying too much for them – and not getting the improved metal grain structure and surface hardness and finish that swaging provides.

Torrington is the top authority on swaging. We originated the process and designed the original equipment. We offer you more swaging experience than any other company in the world. If a part can be swaged, we have the skill and knowledge to produce the dies to swage it. We maintain experimental shops especially to work out your problems. For full information, call in The Torrington Company, Swaging Machine Division, 200 North Street, Torrington, Conn.

progress through precision **ROTARY SWAGING MACHINES**

THE TORRINGTON COMPANY Torrington, Conn.

Dreis & Krump Manufacturing Co, Chicago, has named **R Johnson** vice president, general sales manager. He was formerly sales manager of the Tooling Division

National Acme Co, Cleveland, has promoted **Stanley E Casson** from director of sales to vice president, sales

Heald Machine Co, Worcester, Mass, has appointed **James N Heald II** manager of domestic distributor sales. He has been most recently engaged in numerical control applications and installations involving Heald equipment

NAMES IN THE NEWS...

Cross Co, Detroit, has promoted **Walter R Opel** from engineering manager to chief engineer.

Oliver Machinery Co, Grand Rapids, Mich, has named **Ray C Wing** sales manager of the Metal Working Machinery Division, manufacturer of cutoff saws and heavy duty plate saws.

Chrysler Corp has appointed **Joseph F Kerigan,** general manager of the Stamping Division, to the new post of group executive, stamping, in the Automotive Manufacturing Group. **Harry R Bentley** has been named plant manager of the Trenton, Mich, engine plant. He was previously manager of the Mound Road engine plant in Detroit. **William F Humphrey** has joined Chrysler as director of sales, marine and industrial engine. He was formerly director of sales for Hercules Motor Corp.

Ex-Cell-O-Corp has named James W Hatch general manager of the Downey, Calif, plant.

Hamilton Standard, Windsor Locks, Conn, division of United Aircraft Corp, has appointed **Alfred B Thacher** manager of sales engineering. He was formerly a Dayton representative for the division. **Rex E Moule** has been named chief of basic design at Hamilton. He was formerly manager of the Rawson Clutch-Coupling Division of O S Walker.

Borg-Warner Corp has appointed **Richard H Wheeler** vice president, manufacturing, of the Warner Automotive Division, Auburn, Ind. Prior to joining the organization Mr Wheeler was associated with Black, Sivalls & Bryson Inc as works manager of its Controls Division at Tulsa, Okla.

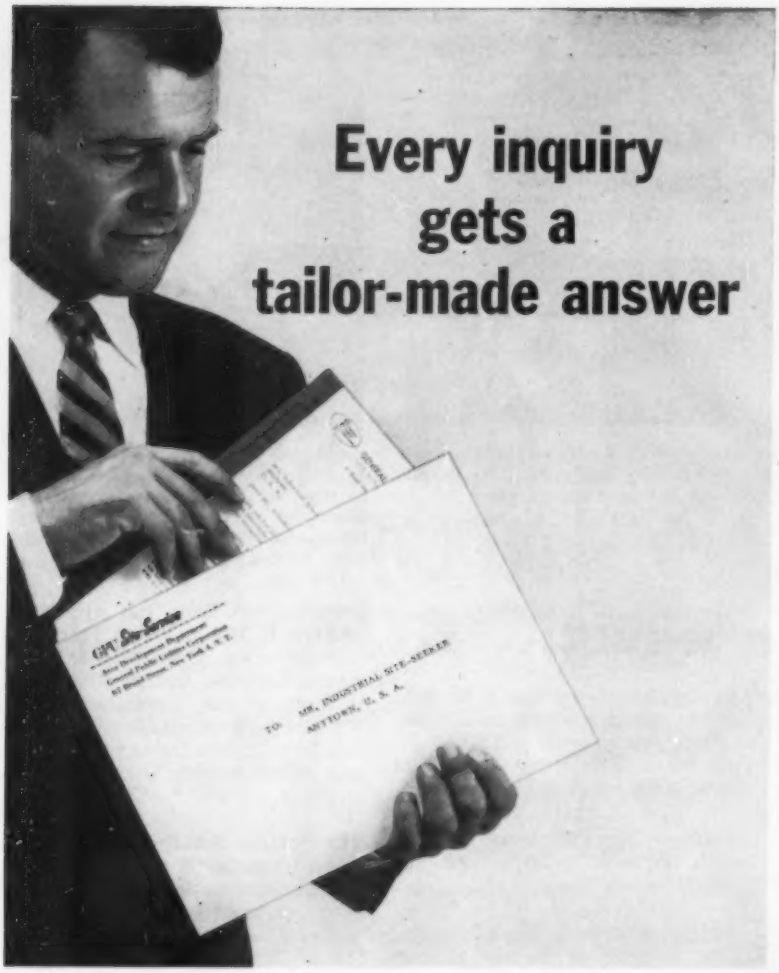
Van Norman Industries Inc has appointed **Charles B Eisenhauer** general manager of the Electronics Division at Manchester, NH. He was formerly director of manufacturing at Continental Diamond Fibre Corp, Newark, Del.

August W Holmberg & Co, Flushing, NY, producer of stampings and automatic assemblies, has named **Ben Berk** chief engineer. Prior to joining the firm he was chief engineer for the Fred Goat Co of Brooklyn.

Cincinnati Milling Machine Co has appointed **David D Black** assistant sales manager for distributor relations of the Cincinnati Milling Products Division. He was previously sales promotion manager of the division

Pratt & Whitney Co, West Hartford, Conn, has named **Daniel C McCarthy** administrative vice president. He was formerly associated with Mobile Oil Co as assistant controller

E W Bliss Co, Canton, Ohio, has appointed **C R Bradlee** manager of cold forming sales for the Press Division. Mr. Bradlee was formerly senior project engineer of cold forming for the Hyatt Bearing Division of General Motors



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gives you complete facts about specific locations to fit your needs

We feel that anyone who writes us deserves a personal reply! That's why your answer will be tailor-made to *your* operations, *your* marketing situation, with plant site recommendations screened to meet *your* requirements. Other companies have already found our personal assistance extremely valuable. You will, too. Write, wire or phone today, knowing that your inquiry will receive prompt, *tailor-made* attention.

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Pennsylvania Electric Co.
New Jersey Power & Light Co.
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GENERAL PUBLIC UTILITIES CORPORATION

Att: Wm. J. Jamieson, Area Development Director, Dept. AM-2
67 Broad St., New York 4, N. Y. WHitehall 3-5600

NAMES IN THE NEWS . . .

Illinois Tool Works, Chicago, has appointed **Stuart A Smith** general sales manager of the Tool and Instrument Division. He was formerly associated with Firth Sterling Inc as district sales manager in Cleveland

Barnes Drill Co, Rockford, Ill, has named **Don Greenberg** chief engineer. He was formerly a sales engineer in the Honing Department

Electric Autolite Co, Toledo, Ohio, has elected **Cecil E Vancil** a vice president. He was formerly associated with Clark Equipment Co as controller of the Industrial Truck Division at Buchanan, Mich. **John M Gerber** has been named general manager of the Wire and Instrument Division and **Edward A McNally** will be in charge of the division's plants at Port Huron, Mich, and Hazleton, Pa.

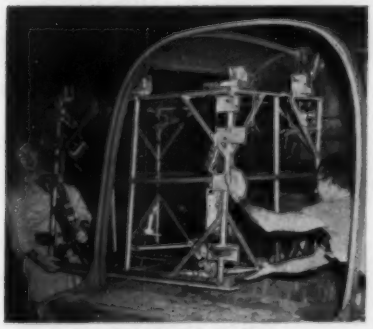
Budd Co, Philadelphia, has promoted **Charles S Herschock** from assistant works manager to works manager of the Hunting Park plant. **Paetrus F Banmiller,** superintendent of methods and equipment, takes over Mr Herschock's former post.

DOW | *Now in magnesium and aluminum*

MAGNESIUM TOOLING PLATE CUTS TOOLING COSTS FOR MAJOR INDUSTRIES

Magnesium tooling plate and extrusions have become accepted as essential tooling materials during the past six years by such cost-conscious industries as automotive, aircraft, missile, machine tools, and electronics. No other tooling material approaches magnesium's unique combination of cost-cutting properties . . . lightness, machinability, flatness, rigidity. You get more metal per pound with magnesium than with any other metal!

Unmatched machinability cuts machining costs.



Magnesium assembly jig is easily handled by two men.

BEST PROOF of magnesium's acceptance as a tooling material is its actual use for: assembly jigs; trim and drill jigs; checking fixtures; templates; base plates; test equipment. Magnesium's acceptance is growing for a very good reason—its properties mean lower tooling costs, better all-around results!

LIGHTWEIGHT magnesium tooling is easy to build, use and handle, reducing fabrication and labor costs. This is the lightest of all structural metals, weighing only one-quarter as much as steel, one-third less than aluminum. Magnesium reduces worker fatigue and accidents, too.

MACHINABILITY. Magnesium is the easiest to machine of all structural metals, for all machining operations . . . sawing, milling, planing, boring, tapping and threading, etc. For example, cutting speeds of up to 5000 feet/minute and cuts of 0.500" in depth are often used in turning. Even at these speeds and cuts, tool wear is less than with other metals.

FLATNESS. Lightweight tooling plate now has closer flatness tolerances than ever before—so close, in fact, that it can be used *as purchased* for nearly every tooling purpose. Surface machining is not necessary! This plate is rolled and stress relieved, and magnesium's dimensional stability *keeps* it flat.

SQUARE MAGNESIUM TUBING is the latest magnesium extrusion shape. This useful form fills out the complete line of extrusions which includes channels, tubing, and most other standard structural shapes.

• • •

Economical magnesium tooling materials have been proved and accepted by the country's major industries. Why not put their advantages to work for you? For a copy of the fact-filled booklet "Magnesium Tooling Plate Shop Manual," or for more information, contact the nearest Dow sales office or write THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Dept. 1031F4-18.

Visit us at Booth 1050, ASTME Tool Show

Auto checking fixture retains dimensional accuracy.

Square magnesium tubing is now available.

See "The Dow Hour of Great Mysteries" on NBC-TV

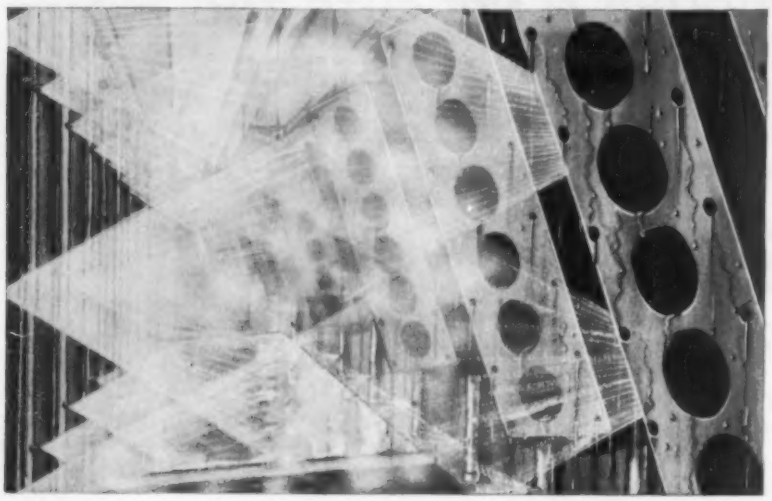
DOW **THE DOW METAL PRODUCTS COMPANY**

Division of The Dow Chemical Company

To get more from your spray washer

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS



New Oakite 198 sprays off soils fast . . . protects in-process parts from rust

Users tell us that nothing equals Oakite 198 for cleaning parts in-process. Here's why they think so:

- *It clears off heaviest soils at temperatures up to 180°F, and light soils at room temperature.*
- *Metal chips wash away under its action.*
- *When dry it leaves a protective film that prevents the rusting of machined or ground parts prior to assembly—yet it doesn't affect accurate gauging.*

Now largely used in automotive plants, Oakite 198 is proving its economy as well as its unique effectiveness in providing fast, smut-free cleaning plus rust protection. It works in single or multistage machines, at economical concentrations.

Oakite 198 is just one of a complete line of Oakite materials for machine cleaning. There are non-foaming solvent agents for heaviest duty cleaning, alkaline cleaners for removing moderate to light soils. When you ask Oakite you can be sure of getting a cleaning compound designed to give you best possible results, designed to reduce your "per unit" cost. You can be sure, too, of getting prompt, intelligent in-plant service from your local Oakite man.

Send for Bulletin. Oakite Products, Inc., 24 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE SCIENCE

50 years' leadership in industrial cleaning

NAMES IN THE NEWS . . .

John A Bradner, president of **Lees-Bradner Co**, Cleveland, has been elected a vice president of the National Metal Trades Association. **John J Hall**, industrial relations director of **Brown & Sharpe Manufacturing Co**, Providence, RI, has also been named a vice president of NMTA

Landers, Frary & Clark, New Britain, Conn, has appointed **Roland J Fernekes** manager of manufacturing engineering. He was formerly chief product engineer for Midland-Ross Corp, producer of power brakes. **Leland C Sharron**, a member of the staff of the Manufacturing Engineering Division, will be responsible for coordinating all tool making and tool designing for the company.

Royal Industries Inc, Los Angeles manufacturer of electronic and electro-mechanical devices, has appointed **P G Smith** executive vice president and **Donald E Butler** vice president, sales. Mr Smith was formerly executive vice president of Airaterra of Glendale, Calif, and vice president and general manager of Roylyn Inc of Glendale. Mr Butler is a former vice president of Airaterra and vice president, foreign licensing, of Roylyn.

Arcair Co, Lancaster, Ohio, manufacturer of torches and electrodes, has appointed **Richard Henderson** chief engineer.

Maytag Co, Newton, Iowa, has named **George M Umbreit** president. Formerly executive vice president, he succeeds **Fred Maytag II**, now board chairman and chief executive officer.

American Emery Wheel Works, Providence, RI, has appointed **Gilbert E Perkins** production manager.

Always . . . ON THE SPOT!

Here is a fast, accurate gage that has a hundred uses. It can be used at the machine, in production, in the inspection department . . . and in the gage laboratory.

Simple to use, it requires no special skill on the part of your personnel. It weighs only 3 lbs.

***MICROtrol*®** 170 transistorized gaging system, which includes a battery-powered amplifier and four types of interchangeable gage heads, is for use with production comparators, height gages, snap gages, ID or OD gages and similar bench inspection devices.

INDICATOR GAGE HEAD used with standard height gage-stand for surface plate work.

AGD GAGE HEAD used with snap gage for production line inspection.

FRICTIONLESS GAGE HEAD used with comparator stand to check production parts.

Features

- *Only 2 control knobs*
- *One adjustment zeros both scales*
- *Large meter with 4.6″ scale*
- *Dual range—from either ± .0003″ to ± .003″ or ± .001″ to ± .010″*
- *Accurate—transistorized throughout*
- *Pocket-sized—5¾″ square by 3⅛″*
- *Mounting adapters and gage head stored in cover*
- *Carrying case handle doubles as amplifier stand*
- *Lightweight—weighs only 3 lbs.*
- *Battery powered—can be used anywhere*
- *AA dry cells can be used in emergency*

***Basic Gages start at* $341.00**

Contact your nearest Cutler-Hammer office or—
Order Direct from

AIRBORNE INSTRUMENTS LABORATORY

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A DIVISION OF CUTLER-HAMMER, INC.

America looks to . . . Hammond for FINISHING and DEBURRING "KNOW-HOW"

The experience gained in over 70 years of machinery building has provided us with a big bank of "Know How."

This knowledge is drawn upon and added to every day. Our business is to share it with you to bring down high finishing costs. Many users of Hammond Automatics have found more efficient means of finishing by drawing on our bank of "Know How."

The Rotary Automatic illustrated represents one of our many types and sizes of automatic finishing machines for either continuous rotation or indexing. The head and stand units shown are a part of a large "family" which range in type and size up to 20 HP.

SEND SAMPLES and we will show you how much you can speed up production and cut costs.

See us at the ASTE SHOW, Detroit, Booth 1027 April 21-28

Hammond Machinery Builders INC.

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CIRCLE 302 READER SERVICE CARD

SHORE SCLEROSCOPE HARDNESS TESTERS

Pioneer American Standard SINCE 1907

Available in Model C-2 direct reading or in Model D dial indicating with equivalent Brinell and Rockwell C Hardness Numbers. May be used free hand or mounted on bench clamp. Sensitive over entire range from softest to hardest of metals without adjustment. Non-injurious to work.

OVER 40,000 IN USE

THE SHORE INSTRUMENT & MFG. CO., INC.
90-35B Van Wyck Exp.
Jamaica 35, N. Y.

MODEL D

MODEL C-2

NAMES IN THE NEWS . . .

United Welders Inc, Bay City, Mich, producer of special-purpose automated welding and processing machines, has appointed **Robert E Groening** general sales manager.

Emhart Manufacturing Co has appointed **Stanley H Maikowski** general superintendent of manufacturing of the Hartford Division, producer of automatic glass making machinery.

AC Spark Plug Division of General Motors has appointed **Howard L Roat** works manager of the Milwaukee operations. He succeeds **Roy E McCullough,** named director of advanced manufacturing development in the division. **Dale Bachtel,** works engineer at AC in Flint, Mich, takes over Mr Roat's former post as manufacturing manager of the division.

Hercules Motors Corp, Canton, Ohio, has named **George W La Salle** vice president, engineering. He has most recently served as coordinator in the development of engines for use by the armed services and other governmental agencies.

Thor Power Tool Co has promoted **Peter Rebeschini** from chief electric tool engineer to chief engineer of the Aurora, Ill, Works.

Parker Rust Proof Co, Detroit manufacturer of surface treatments for metals, has elected **E B Thompson** a vice president. He has been general sales manager since 1954.

Titan Metal Manufacturing Co, Newark, Calif, producer of brass and bronze products, has promoted **George J Miller** from chief metallurgist and chemist to plant superintendent.

OBITUARIES

William F Shore, 76, president and co-founder in 1907 of **Shore Instrument & Mfg Co,** Jamaica, NY, died Mar 14. Mr Shore was the inventor of the Scleroscope for testing the hardness of metals and the Durometer for rubber hardness testing.

Carl T Weitzel, 67, founder and president of **Mechanical Specialties Co,** Los Angeles tool and die manufacturing firm, died Mar 13.

NEW BULLDOG XL BUSTRIBUTION DUCT...

3 WAYS SAFER FOR PEOPLE AND PROPERTY

HERE'S THE FIRST DEAD-FRONT plug-in duct. Butyl insulation covers the full length of each silvered aluminum bus bar, *even in bus plug openings.* You get positive protection for personnel against accidental contact with "live" bars.

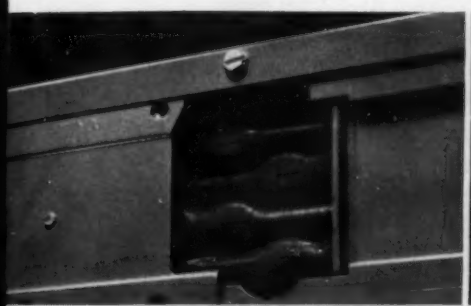
PLUG-IN SAFETY DOOR IS ALWAYS CLOSED during installation of XL Safety Plug. Interlock finger positively prevents plug installation or removal when Safety Door is open . . . and it keeps door from closing against "live" plug fingers.

THERE'S NO ARCING to endanger people or property . . . you can't plug in or unplug when the switch is "ON."

New XL BUStribution® Duct cuts down installation time . . . takes less space . . . reduces duct weight on building structure as much as 40%. Keyed bus ends slip together in a hurry while a single integral bolt locks joints securely under a ton of pressure.

Ask your BullDog distributor to arrange for a demonstration. You'll see how fast-to-install XL BUStribution Duct and matching Safety Plugs really are!

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Michigan. In Canada: 80 Clayson Rd., Toronto 15, Ont. Export Division: 13 East 40th St., New York 16, N. Y.



IT'S TRUE DEAD-FRONT. Each silvered aluminum bus bar is full-length insulated with Butyl envelope.

IT'S A SAFETY DOOR. You can't plug in or unplug with the door open, can't close door on "live" plug fingers.

IT'S A SAFETY PLUG. You can't plug in or unplug against a load . . . safeguards personnel and equipment against arcing.

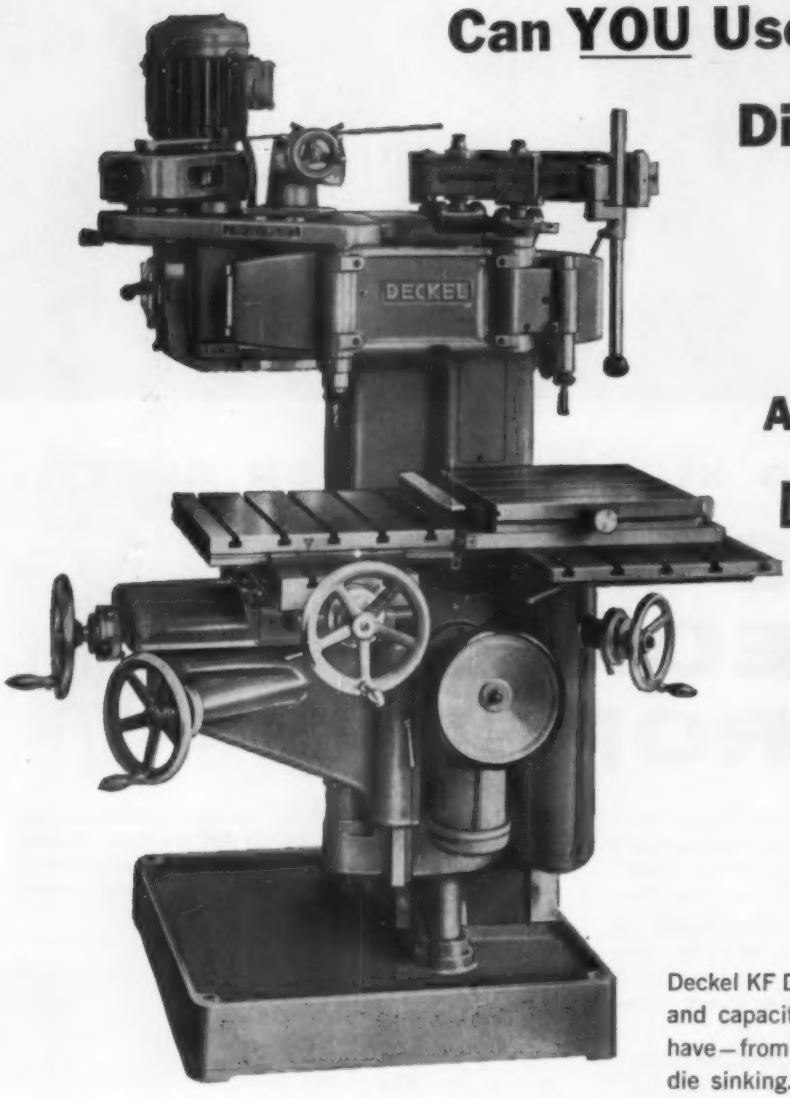
BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY

®

KEEP PACE WITH ELECTRICITY

CIRCLE 304 READER SERVICE CARD

Can YOU Use These Die-Sinking Features?



Deckel KF-12 Die Sinker with power lift motor for raising or lowering work and pattern tables simultaneously

Available On A DECKEL Universal Pantograph Die-Sinking Machine

Deckel KF Die Sinkers have the versatility and capacity to take any job you might have—from light engraving to the heaviest die sinking. Their wide range of application lets you handle more work with less equipment. A Deckel KF-12, for example, can accommodate dies and molds up to 1300 lbs., and offers cutter spindle speeds from 60 to 10,000 rpm. Deckel KF machines can duplicate directly at a 1:1 ratio, enlarge or reduce up to a 1:4 ratio. Rugged pantograph construction and play-free bearings assure accurate, easy control of all operations.

OTHER DECKEL FEATURES

Optical Tracing
Reverse (mirror) Duplicating
Line-By-Line Milling
Automatic Depth Feed
Pattern Forming
Roll Profiling
Rough & Finish Milling

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Nationwide Sales and Service
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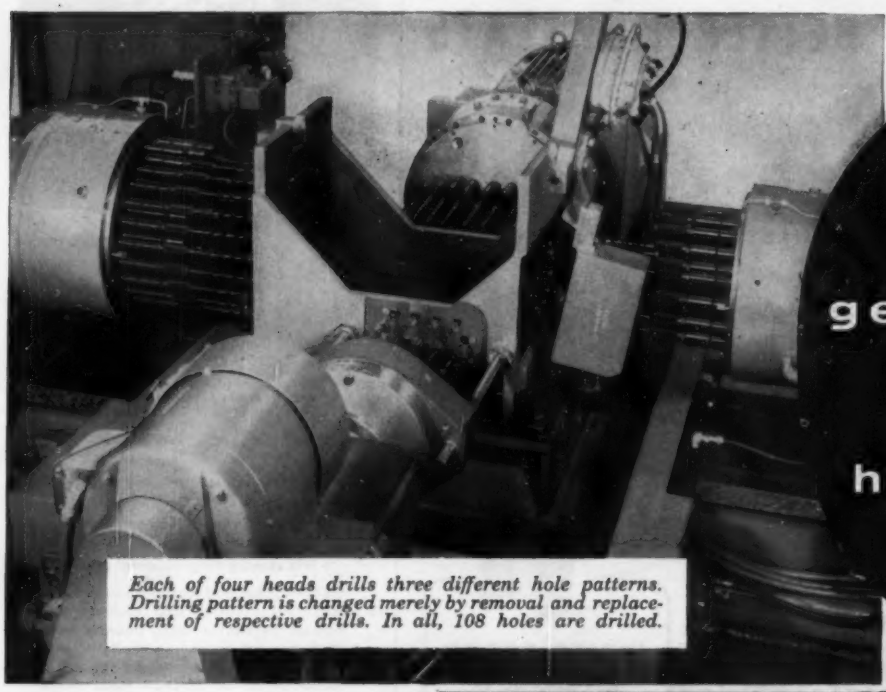
IN CANADA contact COSA CORPORATION OF CANADA, LTD., 1160 Lakeshore Road, Long Branch, Toronto 14, Ontario



why gearless drill heads?

Each of four heads drills three different hole patterns. Drilling pattern is changed merely by removal and replacement of respective drills. In all, 108 holes are drilled.

because Zagar *gearless design can use more spindles and do more work*

Zagar gearless design in multiple spindle machining permits a flexibility unmatched by any other equipment. Basically, the application of more and still more spindles is the key to savings in every stage of the job. From incipient engineering through cost per part (or cost per hole), every step is marked by cost-saving over any other approach. As spindles are added, cost per spindle actually decreases. This advantage obtains whether the head is designed to produce one part or more than one part of varying machining patterns.

When drilling, reaming and tapping on more than one part, Zagar can often apply one head to do several patterns. Zagar heads drill, ream, and tap varying diameters on any center.

Write for Engineering Manual A-2 for technical reference.

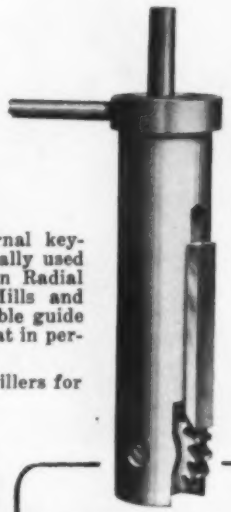
Zagar INCORPORATED

23886 Lakeland Blvd. • Cleveland 23, Ohio

USE MORE SPINDLES TO DO MORE WORK

THE KEY TO BETTER KEYSEATS

NATIONAL
Keyseating Millers



NATIONAL Keyseating Millers are mechanically simple in construction, sturdily built, designed for milling internal keyseats, faster and better. Although principally used in Drill Presses they can also be used in Radial Drilling Machines, Horizontal Boring Mills and Milling Machines. An exclusive demountable guide on body of Miller assures a straight keyseat in perfect alignment with axis of bore.

You can depend on National Keyseating Millers for all your keyseating jobs.

national
MACHINE TOOL CO.
CINCINNATI 22, OHIO

WRITE TODAY
for Catalog No. 17
complete, handy size

CIRCLE 307 READER SERVICE CARD

REPLACE
SOLID BUSHINGS
with
JERGENS
ADJUSTABLE BEARINGS

on
JIGS FIXTURES MACHINES

JERGENS "LIVE" BUSHINGS

- Increase Speeds, Feeds, 200%
- Reduce Tool Breakage
- Eliminate Bushing Wear
- Use Economical Carbide Cutters
- Provide Greater Precision
- Available for ½" to 6½" Shafts
- Will stand greater sidewall pressures

Get time, tool, and money-saving advantages by replacing solid bushings with Jergens adjustable roller bearing units. Available for ½" to 6" shafts or with straight roller bearings where space is a factor in ½" to 2" shaft sizes. Write today for complete information and authentic case histories.

DONLEY PRODUCTS, INC.
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CIRCLE 309 READER SERVICE CARD

WILSON Pneumatic Horizontal Grinders

Faster grinding...less operator fatigue

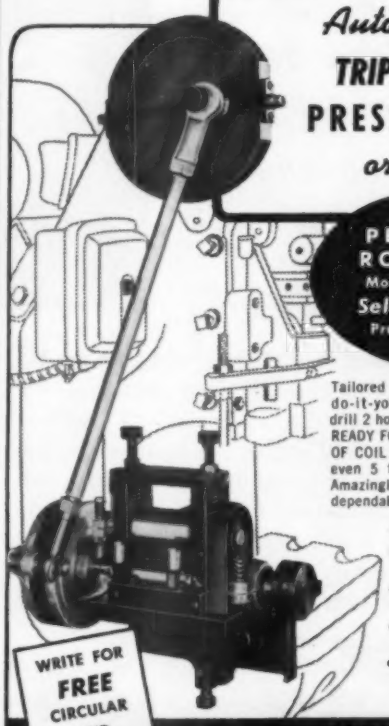
Wilson's new Horizontal Grinders speed grinding, buffing, wire wheel work and many other metal removing and finishing operations. Available in various sizes and models, with speeds ranging from 3100 to 12,000 r.p.m. Write for Catalog PT-58.

TW922

THOMAS C. WILSON, INC.
21-11 44th Avenue, Long Island City 1, New York
BETTER TOOLS FOR BETTER WORK

CIRCLE 308 READER SERVICE CARD

Automatically
TRIPLES YOUR PRESS OUTPUT
or more!



PETERSON ROLL FEED
Model DD-32 with
Select-O-Matic
Precision Indexer

Tailored to fit your press. Easy, do-it-yourself installation. Just drill 2 holes, bolt on, and YOU'RE READY FOR AUTOMATIC FEEDING OF COIL STOCK that gives 3, 4, even 5 times more production. Amazingly versatile, accurate, dependable, durable.

- FAST DELIVERY
- 36 STANDARD MODELS
- FEED LENGTHS 0-12"
- WIDTHS UP TO 12"
- Special models for wider stock

WRITE FOR **FREE** CIRCULAR AND PRICE LIST

CARL G. PETERSON CO.
9 Warren Avenue, East Providence, R. I.

CIRCLE 310 READER SERVICE CARD

Every Year: *the whiskers on America's old lathes grow longer!*

. . . And as a manufacturer don't you find imports and substitutes grabbing more and more of your markets every day? Largely on a price basis?

Any connection between antiquated lathes and lost markets? You know it!

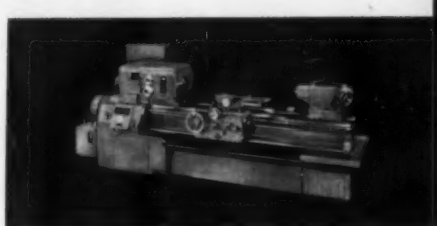
Consider these alarming facts. In 1945, 38% of all America's machine tools were ten years old or older. In 1953, 55%. In 1958, 60%. Yes, 60%!

The lathe story is even more disturbing. Right now 72% of all engine lathes are over 10 years old. Almost 40% of these are over 20 years old.

Think of that in terms of productivity. A twenty-year old 16" slowpoke, with a 7½ H.P. motor, delivers a top metal removal rate of 9½ cubic inches per minute. A ten-year old with 10 H.P. delivers a 15 cubic inch rate. *And yet today's Monarch 20 H.P. job throws chips at a 36 cubic inch rate.*

There are other factors, too. With old machines, the cost saving advantages of throwaway tools and negative rakes cannot be realized. High temperature alloys and many other materials cannot be turned economically without today's oxide and harder TiC carbide tools. And savings on modern lathes with tracer controls are phenomenal.

As never before, American industry must today study every avenue of possible cost reduction. For some, it may be a matter of sheer survival. Ancient lathes will not help meet tomorrow's competition. Modern Monarchs will . . . *The Monarch Machine Tool Company,* Sidney, Ohio.



Not one of these MODERN MONARCHS was available 5 years ago. Some, not even a year ago.

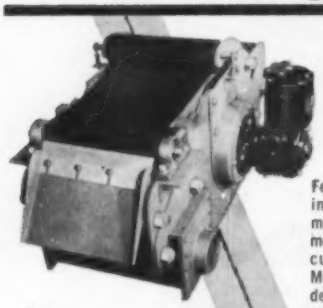
Series 62 Preselector Dyna-Shift Lathe
Series 80 Heavy Duty Dyna-Shift Lathe
Series 90 Heavy Duty Dyna-Shift Lathe
Series 180 Ultra-Precision Contouring Lathe
The Missile Master
Rotary Profile Tracer Lathe
. . . And Others

Monarch
TURNING MACHINES
ACCURACY • ECONOMY • LONG LIFE

IF IT CAN BE TURNED, THERE'S A MONARCH TO DO IT BETTER AND FASTER

CIRCLE 311 READER SERVICE CARD

GALE OFFERS 5 COOLANT CLEANING AND OIL SEPARATION EQUIPMENT for the metalworking industry

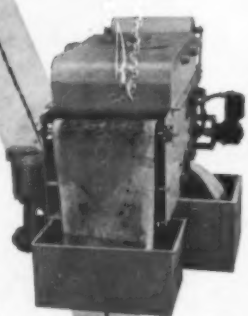


1 MAGNETIC CLEANING

Ferrous metal particles produced in grinding, honing and other machining operations are removed from any type coolant or cutting oil by the "GALE" Magnetic Separator. Solids are delivered near-dry for easy disposal.

2 NON-MAGNETIC CLEANING

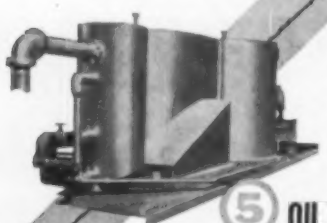
Ferrous and non-ferrous metals as well as non-metallic solids are removed from coolant liquids with equal efficiency by the IMPINJO® Filter. An automatically controlled moving filter medium simplifies disposal of waste solids.



3 EXTRA FINE CLEANING

Grinding and polishing to a low micro-inch finish requires abrasive-free recirculating coolants. Diatomaceous filtration removes surface-damaging micronic and colloidal solids. Recommended for aluminum rolling oils and other industrial filtering problems.

4 CENTRAL SYSTEM PURIFICATION



Centralized cleaning to serve many machines using the same coolant is accomplished by flotation and sedimentation. The SEDIFLOTOR® Clarifier is available in capacities for any coolant flow requirement.

5 OIL SEPARATION

Free un-emulsified oil and grease contamination in liquids is eliminated by the "GALE" Interceptor-Separator. Oils are removed and separated liquid is discharged.

The GALE Separator Co. is a Division of INFILCO Inc., world leaders in liquid treating equipment.

GALE SEPARATOR Co.

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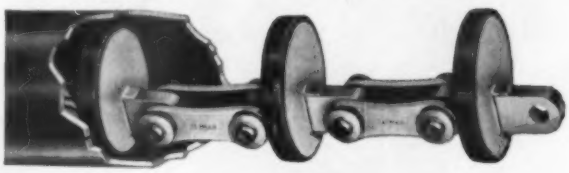

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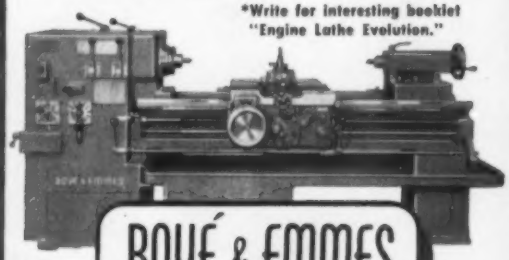

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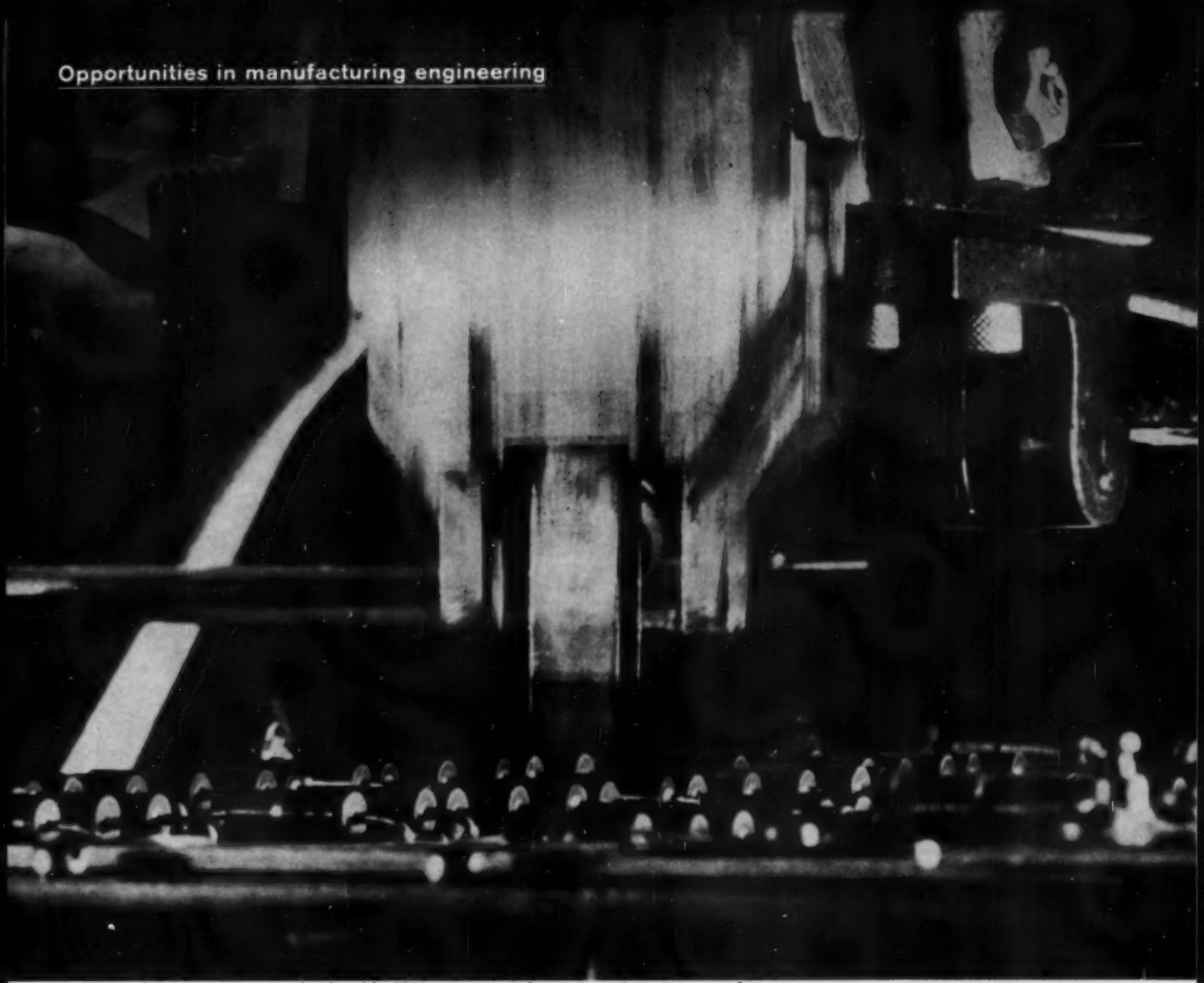

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10	54"	Colonial	VA2-10-54-D2	Dual	Shuttle
15	72"	LaPointe	SRV-15-72	Single	Rotpro.
15	60"	Colonial	VA1-15-60-SL	Single	
25	96"	American	SBD 96-25	Dual	Shuttle
30	72"	American	SBD 72-30	Dual	Swivel
10	96"	American	T-10-96	Single	Tri-Way

HORIZONTAL

Tons	STROKE	MAKE	MODEL	RAMS
35	60"	LaPointe	4L	Single
6	48"	Oilgear	XL-12	Single
50	72"	LaPointe	HP-100	Single

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TABLES, AUTOMATIC INDEXING 12", 14", 16", 20", 24", 30" and 42" dia.

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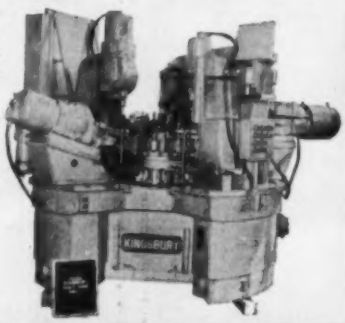

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- In New Condition.
- Single End, Single Spindle.
- Machine will bore, turn and face, either straight or on irregular contour.
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- Infinite Spindle speeds with variable DC Drive
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- 10" Air Cylinder on Spindle.
- Jib Crane with Air Hoist, for work handling.
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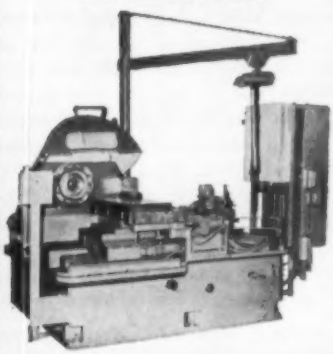

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36" Cincinnati Shaper, Rapid Traverse, Electric Clutch, Power Feed to Head. 1953.

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6'17" Fosdick Radial Drill, 1400 RPM, #6 Taper, Rapid Traverse.

B4B Natco Holesteel Multiple Spindle Drill, 48 Adjustable Arms and Spindles, #2 Taper.

KELLER TYPE BG3 AUTOMATIC DUPLICATOR 144" Horiz., 78" Vert., Cap., 10' x 14' Bed, 92" Angle Plate, MG Set, Chip Conveyor.

FOSDICK #42 JIG BORER 22" x 42" Table, 42" Travel, 1500 RPM, Serial #15280.

10' x ¾" CINCINNATI #2510 SHEAR Back Gauge, Front Squaring Arm, 1948.

#W-8 BAUSH MULTIPLE SPINDLE DRILLS Drill Area 42" x 48", 16 Spindles 2½" in Diameter 48" Index Table.

#281 HEALD Internal Centerless Grinder, Serial #31650 (2).

#2 CINCINNATI CHUCKING GRINDERS, 10" capacity, Automatic Cycle. 1950 (2)

#33 SUNDSTRAND FLUID SCREW SIMPLEX MILL, 120" Table travel.

#WB 4-SPINDLE CONE 2⅛" Automatic Cut-Off Machine.

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Listed below are used, surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name, indicates the products or services offered by the advertiser.

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6. Boring Mills
7. Broaching Machines
9. Centering Machines
10. Chucking Machines
11. Compressors
12. Cranes
13. Cutting Off Machines
16. Drilling & Reaming Machines
17. Electric Motors
20. Forging Equipment
23. Gear Cutting Machines
24. Grinding Machines
29. Lathes
33. Milling Machines
37. Planers
39. Power Equipment
40. Press Brakes
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51. Shears
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58. Welding Equipment
61. Machine Tools
64. Surface Plates

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*#18 Blanchard V. Rotary, 30" (1941)
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*20x72" Monarch w/Air Gage Tracer (1948)

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*#2 Van Norman Universal Rebuilt Cond.
*26 Van Norman Swivel Head Ser 5700
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*#35—1448 Sundstrand 600 RPM (1944)
*#35-2448 Sundstrand Horiz. Hydr. Auto Cycle (1952)
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*28-60 Cinc Vert Hydrotel 360° Tracer
*8 Spdl Cinc Vert Hydrotel 28x134" Tbl

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22" x 24" centers Monarch Model CM Geared Head Lathe, actual swing 27½", 16 speeds, two Carriages, tapers.
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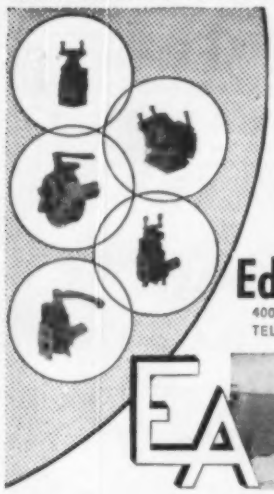
TURRET LATHE TOOLING



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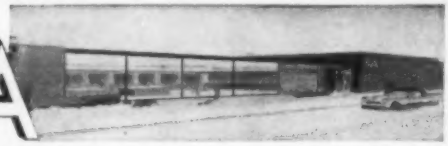

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48,000 SQ. FT.
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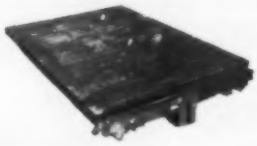

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135 tons, Bliss #6-48, Bed 48"x30"
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Bliss #6150 High Speed Double Roll Feeds
Bliss #6458, Bed 48"x18", Str. 4"
LeBlond Engine Lathe, Type NK, 30" swing x 37' centers, 2 carriages
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12" x ¼" Cincinnati Shear, 1951
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7'17" American Hole Wizard Radial Drill, 1943
4½ Kling Hydraulic Friction Saw, 125 HP
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Made of selected, full individual stones, mounted in 7/16" diameter x 6" long cold rolled shank.

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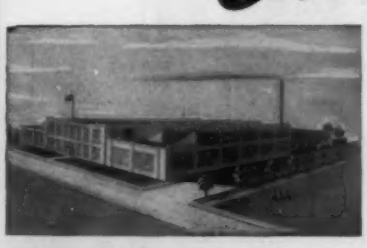

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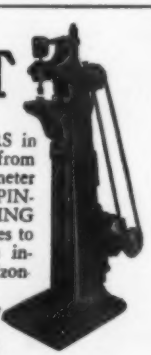

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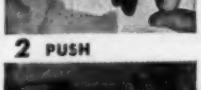
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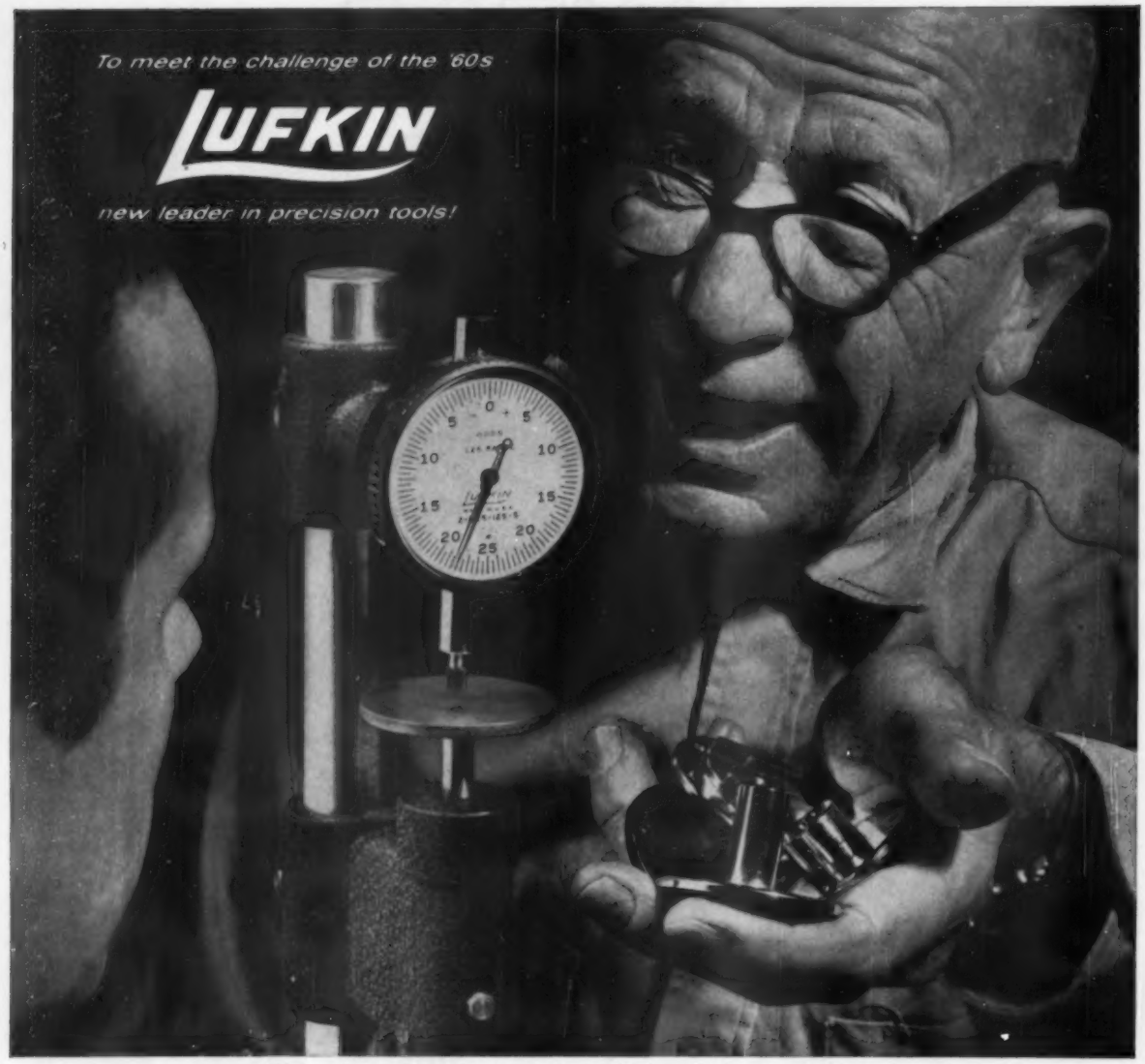

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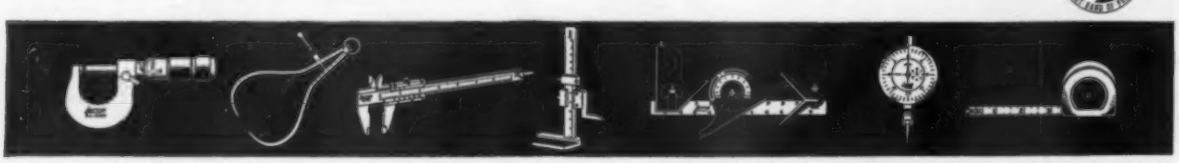

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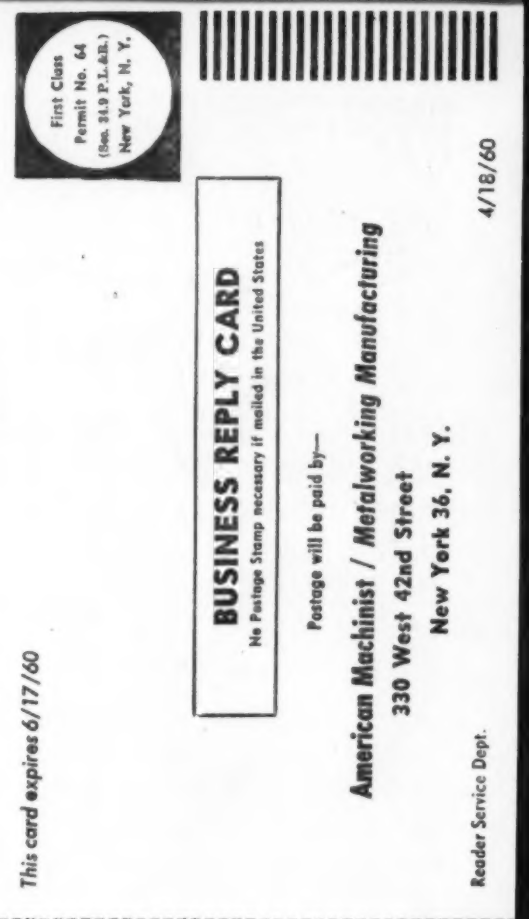
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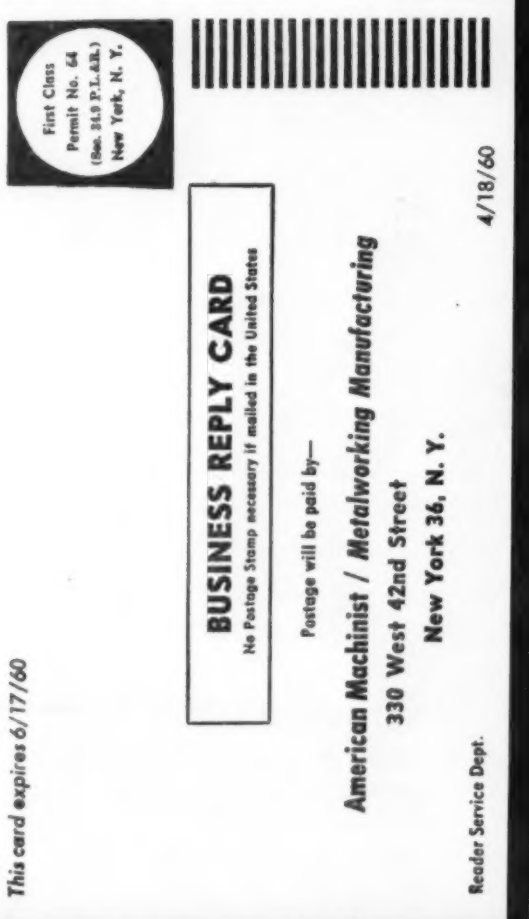
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